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Hydraulics & Pneumatics

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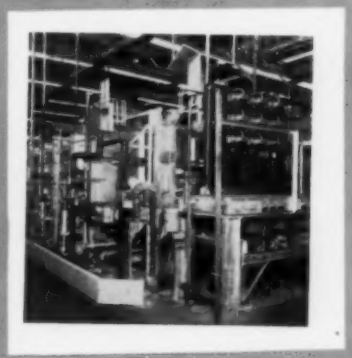

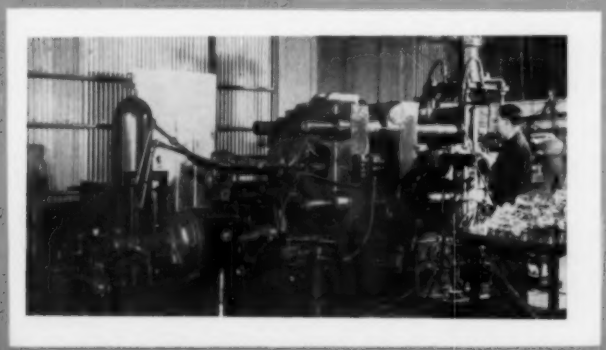

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THE MAGAZINE OF FLUID POWER

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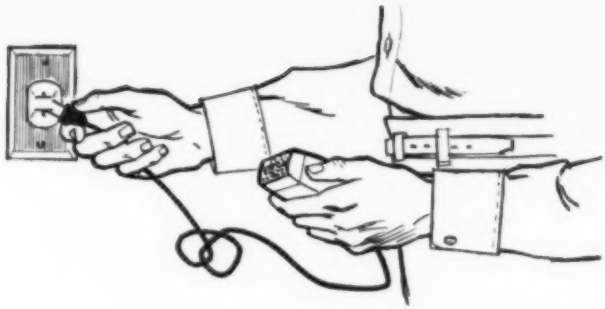

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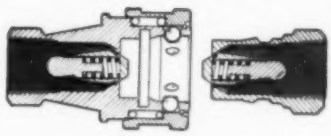

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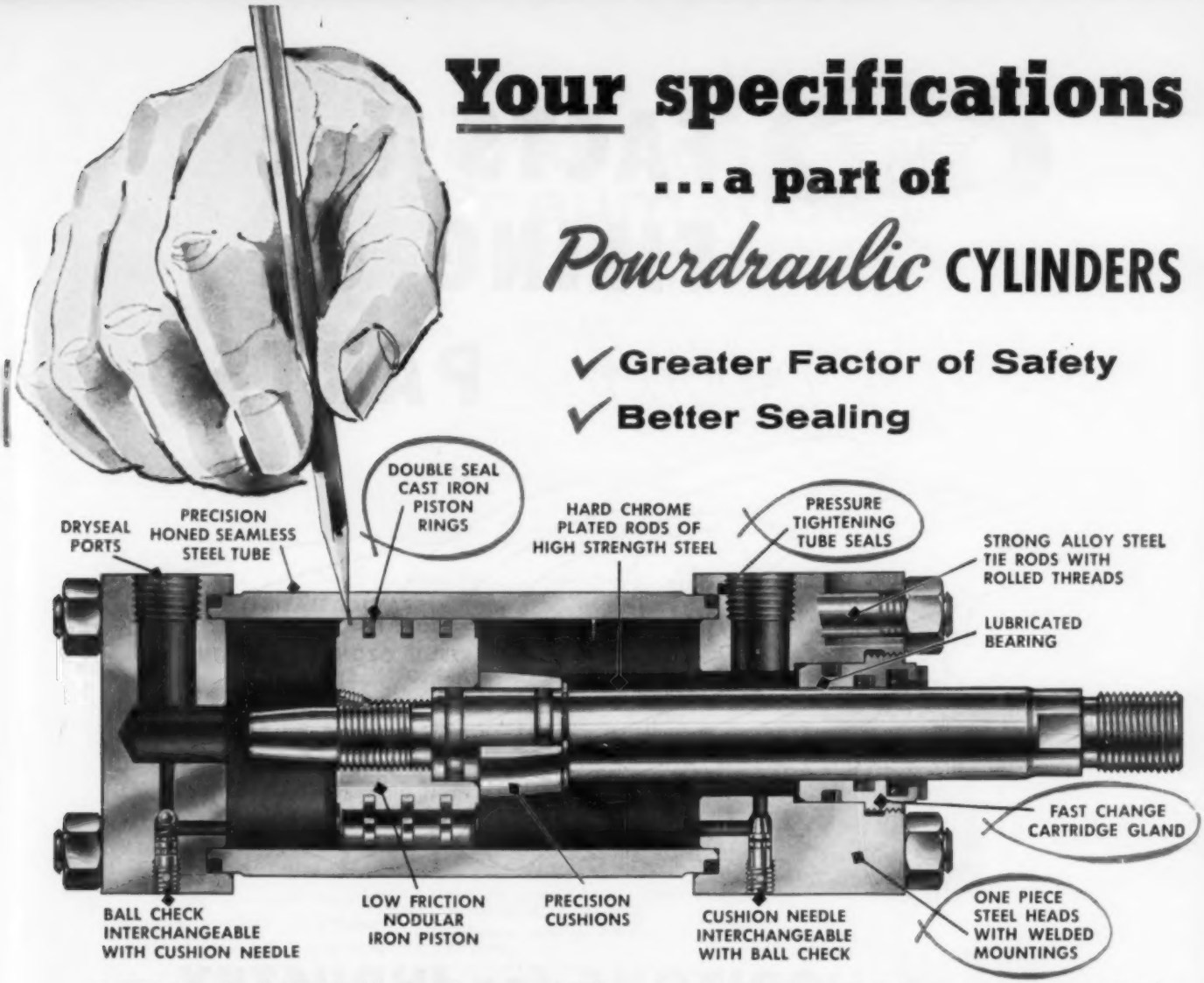
DOUBLE SEAL CAST IRON PISTON RINGS
DRYSEAL PORTS
PRECISION HONED SEAMLESS STEEL TUBE
HARD CHROME PLATED RODS OF HIGH STRENGTH STEEL
PRESSURE TIGHTENING TUBE SEALS
STRONG ALLOY STEEL TIE RODS WITH ROLLED THREADS
LUBRICATED BEARING
FAST CHANGE CARTRIDGE GLAND
ONE PIECE STEEL HEADS WITH WELDED MOUNTINGS
BALL CHECK INTERCHANGEABLE WITH CUSHION NEEDLE
LOW FRICTION NODULAR IRON PISTON
PRECISION CUSHIONS
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HANNA Powrdraulic Hydraulic Cylinders meet J. I. C. recommendations and have industry standard mounting dimensions—2000 psi and 3000 psi non-shock. 1½" through 8" bores.

EXCLUSIVE PRESSURE TIGHTENING TUBE SEALS, located on the outside diameter of the cylinder tube, form a positive seal at all pressures from zero to maximum. Minute expansion of the tube due to pressure, squeezes the "O" ring making the seal even tighter. The "O" ring is fully confined between the head and the tube and will not extrude at high pressures. Unlike other cylinders that seal at the tube ends or inside diameter, the Hanna Powrdraulic Cylinder with pressure tightening O.D. seals will remain tight at all pressures.

DOUBLE SEAL PISTON RINGS give you twice the sealing power of conventional piston rings. These bi-directional, cast iron rings, consisting of a ring within a ring, seal both the "in" stroke and the "out" stroke of the cylinder. The piston with double seal rings is packed for life and never should need replacement. You may also choose the optional piston with "U" type synthetic packings.

FAST CHANGE CARTRIDGE GLAND equipped with a leak proof, low friction rod seal forms a tight seal from zero to maximum pressure. Built in rod wiper removes dirt and particles from piston rod as the rod moves "in" and serves as another hydraulic seal to wipe the rod dry on the "out" stroke. You can select either the standard gland or the optional, multiple lip, spring loaded seal. The optional gland is interchangeable and is available with synthetic rubber or Teflon* Vee packing.

ONE PIECE STEEL HEADS WITH WELDED MOUNTINGS are much stronger than conventional bolted construction and assure squareness of mountings. All mountings are designed to carry maximum cylinder loads with a generous safety margin.

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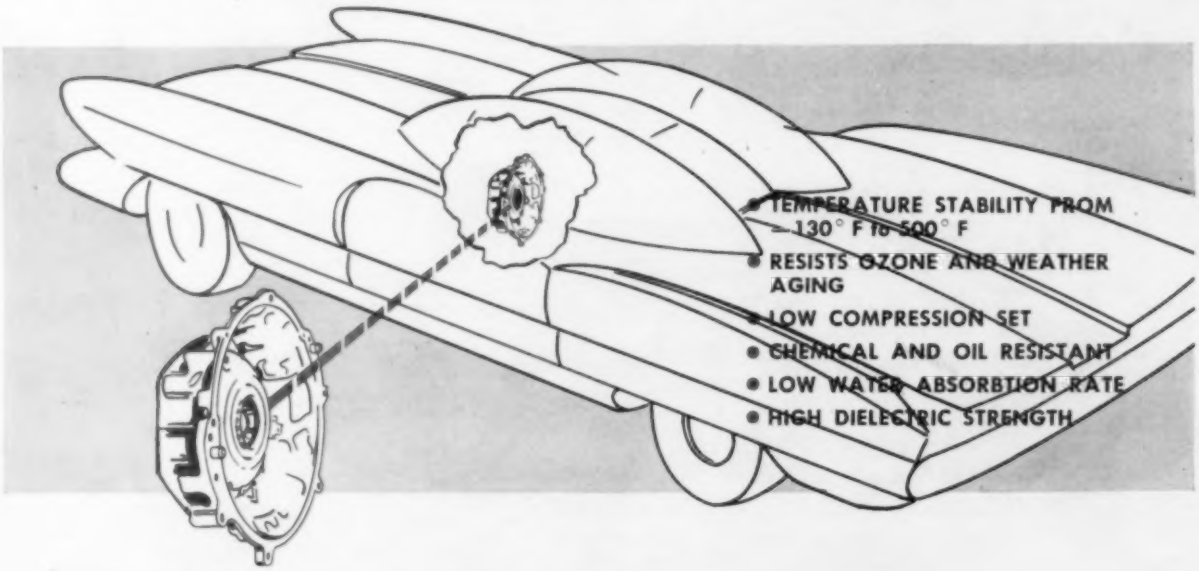
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- **Compression set, % @ 300 F** ..... 15 to 40
- **Hardness range, durometer** ..... 20 to 90
- **Dielectric strength, volts/mil** ..... 400 to 500
- **Oil resistance, depending on oil** ..... good to excellent

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VOLUME 12/NUMBER 11

NOVEMBER 1959

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VITAL HYDRAULIC
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A bright design idea! – a ditching machine with hydraulic-powered crowding, controlled independently of the ditching wheel and the spoil conveyor. And it comes to life with Waterman Series 1407 Flow Regulators in the *Control Zone*. Rated for pressures to 3000 p.s.i., and for *controlled* flow rates to 40 g.p.m., Series 1407 Flow Regulators are ideal for the control of hydraulic motors. A 180° turn of the calibrated handle provides a turndown of as much as 80 to 1, with precise, pressure-compensated flow control at any setting. Also available for panel mounting and manifold mounting.

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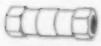

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W-5919

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NEW CONDENSED CATALOG ON ANCHOR HYDRAULIC HOSE ASSEMBLIES

Users and manufacturers of hydraulic equipment will find the Anchor Condensed Catalog No. 59-S a most valuable adjunct to their engineering or maintenance files.

It contains a condensed, yet very complete presentation of the Anchor Line of Hydraulic Hose Assemblies, Couplings and Fittings. The Anchor Line is so reviewed as to greatly simplify selection of the correct Hose Assembly, Coupling or Fitting for any given application.

Included in this catalog are descriptions of the most standard Anchor Products, including Anchor Ductile Sleeve Couplings and other permanently applied Couplings with 2-Wire Braid Hose for high pressures, and with 1-Wire Braid Hi-Burst 2-Rayon Braid, or Spiral Wire Braid for medium and low pressures.

Also described are Anchor Reusable Couplings which include the commercial Duloc Couplings for QW and QWR Hose and Anchor Standard Reusable Couplings with 2-Wire Braid Hose for high pressures, with 1-Wire Braid Hose, Hi-Burst and Standard 2-Rayon Braid Hose for medium and low pressures. Anchor FLANCO 4-Bolt Split-Flange "O" Ring Couplings and Clamp-Type Hose Couplings for quick, easy emergency repair are listed.

The right fitting to suit practically any piping situation can be found in the Anchor Line of Adapter Unions and Pipe Fittings with its wide range of sizes and thread combinations.

Also shown are the new Anchor SAE Adapters and Fittings designed to SAE Straight Thread "O" Ring Boss standards, which are carried in stock.

This condensed catalog of Anchor standard stock products is now available on written request. Write Anchor Coupling Co. Inc., 360 North Fourth Street, Libertyville, Illinois, and ask for New Condensed Catalog No. 59-S.

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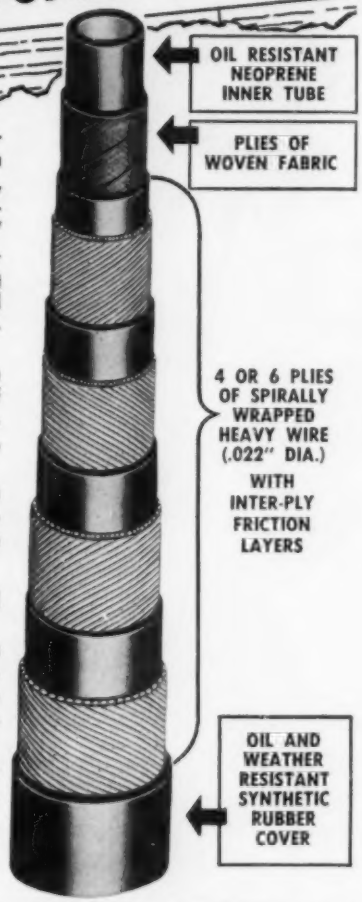
EXTRA!

HIGHER HYDRAULIC PRESSURES NOW FEASIBLE WITH NEW ANCHOR "SUPER-SPIRAL" HOSE


OIL RESISTANT NEOPRENE INNER TUBE
PLIES OF WOVEN FABRIC
4 OR 6 PLIES OF SPIRALLY WRAPPED HEAVY WIRE (.022" DIA.) WITH INTER-PLY FRICTION LAYERS
OIL AND WEATHER RESISTANT SYNTHETIC RUBBER COVER

Designers of hydraulic equipment wishing to increase pressures have been hampered by the lack of dependable, extra high pressure hose. With the introduction of Anchor's "SUPER-SPIRAL" Hose, these limitations have been removed. This hose is already finding wide usage in the replacement of old style braid hose to obtain greatly extended service life.

This hose, available in sizes from 3/16" to 1½" has either 4 or 6 plies of all spirally wound heavy wire reinforcement, with no crossed wires to fatigue, break and weaken hose.

It offers a completely new maximum pressure range for the hydraulic engineer,—opens up new horizons for the hydraulic designer.

- **4 or 6 Plies of Spirally Wound Wire Reinforcement**
- **Maximum Working Pressures from 12,500 psi (3/16" I.D.—6-Ply) to 2500 psi (1½" I.D.—4-Ply)**
- **Heavy Wire, .022" Dia., Reinforcement**
- **All Spirally Wound—No Braid, No Crossed Wires That Lead to Wire Fatigue**
- **Available with Any Anchor Pressed-On Couplings**

Andy Anchor says:
You will find all descriptive details and specifications on Anchor's new "SUPER-SPIRAL" High Pressure Hose and the Couplings in a special data sheet now available on request.

I.D.	FOUR PLY		SIX PLY	
	MAX. WORK. PRES. (psi)	MIN. BURST. PRES. (psi)	MAX. WORK. PRES. (psi)	MIN. BURST. PRES. (psi)
3/16"	10,000	40,000	12,500	50,000
1/4"	8,750	35,000	11,250	45,000
3/8"	7,500	30,000	10,000	40,000
1/2"	6,250	25,000	7,500	30,000
3/4"	5,000	20,000	6,250	25,000
1"	4,000	16,000	5,000	20,000
1-1/4"	3,000	12,000	3,500	14,000
1-1/2"	2,500	10,000	3,000	12,000
*2"	2,000	8,000	2,500	10,000

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ANCHOR COUPLING CO. INC.

359 No. Fourth St., Libertyville, Ill.
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FOR PRESSURES UP TO 750 psig . . . . .

NEW Stainless Steel *Fulflo* FILTER

This rugged, compact filter is ideal for high pressure pneumatic and hydraulic applications. Maximum air flow rate is 650 SCFM at 750 psig with initial pressure loss of 3 psi. Flow rate for liquids of aqueous viscosity is up to 5 gpm, depending on nature of fluid, contaminant and operating conditions.

Patented 10-inch Honeycomb Filter Tubes provide true *depth* filtration through hundreds of filtering tunnels engineered for uniformity of size, shape and depth. Tubes are precision manufactured in a wide range of positively controlled densities to provide the exact degree of micro-clarity your operation requires — even down to 1 micron. Tubes are available in cotton, nylon, orlon, dynel, acetate and glass fibres.

Rugged one-piece shell is made from Type 316L stainless steel. All parts are of #316 stainless steel to minimize chemical reaction. Straight line pipe connections are ¾" NPT. Overall filter size is only 13 5/16" x 4 3/8".

Write for Bulletin S600 to Dep't AH

COMMERCIAL FILTERS CORPORATION
MELROSE 76, MASSACHUSETTS
PLANTS IN MELROSE, MASSACHUSETTS AND LEBANON, INDIANA

MICRO-CLARITY AT MINIMUM COST

Fulflo FILTERS — *with genuine Honeycomb Filter Tubes for controlled micro-clarity of industrial fluids.*

CFC FILTERS — *Selective filtration of oils • water-oil separators • magnetic separators • pre-coat filters • coolant clarifiers • automatic tubular conveyors.*

. . . Fluid Power news

REPORT No. 11,703 NEW SPEED FOR SHIP'S FREIGHT ELEVATORS

From Oilgear Application-Engineering* Files

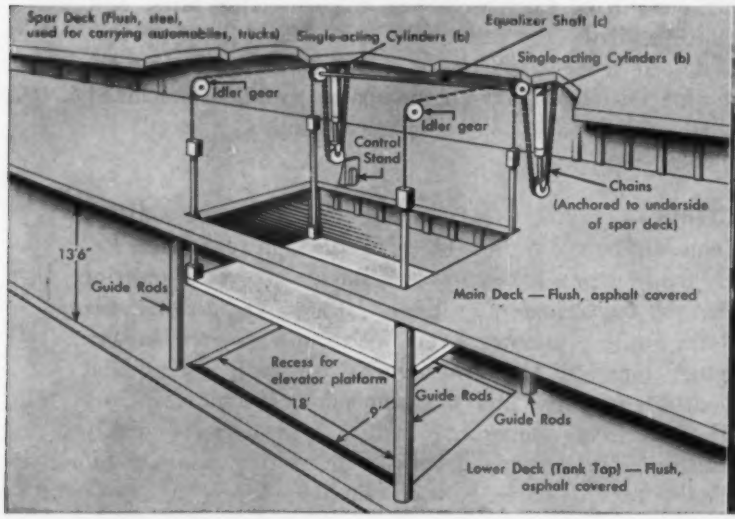
HOW OILGEAR Æ* SOLVED PROBLEMS OF HIGH-SPEED, SHIPBOARD FREIGHT ELEVATORS

OWNER: Canada Steamship Lines Limited

(Builder — Collingwood Shipyards, Division of Canadian Shipbuilding & Engineering Limited)

DATA: Oilgear was employed on a consulting basis to decide which of two experimental hydraulic systems should replace slow, untidy, steam, shipboard freight elevators. (Both systems were found to have serious power, control, or installation problems.)

REQUIREMENTS: 1: Power and control for four elevators in each of two new 460-ft. ships — the S.S. Fort Henry, and S.S. Fort York . . . the first new Great Lakes package freighters to be built in over 25 years. Both ships will be required to maintain fast, tight schedules with palletized freight or bulk grain. 2: A 16-second max. time for the 13½-ft lift-lower cycle with a 10-ton load. 3: Be completely "fail-safe" in event of power failure. 4: Platforms must have four-way, drive-on, drive-off lift truck accessibility — eliminating counterweight systems. 5: Systems must be leak-tight and have provisions for complete "sealing-off" when grain is carried. 6: Must be thrifty with electrical power, as all four elevators operate simultaneously — a heavy load on the ship's power generating system.



SOLUTION: A new Oilgear power and control system for each of four elevators per ship that surpasses all original requirements . . . has many "Patent Pending" features. For each elevator there is an Oilgear "Power-Pak" using a size DH-60, variable displacement, two-way pump with hydraulic servo control, an electric motor, mounted on a semi-hermetically sealed reservoir. "Down cycle" power regeneration is an outstanding feature that provides exceptional electric power economy. In regeneration, the downward load on cylinder fluid drives the Oilgear pump as a motor — driving the electric motor, reducing electrical power input. This system could regenerate ALL of the energy stored in the elevator platform and payload, if the ship's electrical system could absorb the feedback from the electric motors. As the generating system cannot stand a high degree of electrical feedback, an Oilgear regeneration limitation control valve is installed to closely limit the amount of regeneration practical to use during the "down" cycle of the elevators. Other features are: 1: Speed of operation — lift-lower cycle averages 14 seconds . . . an increase of 10 complete work cycles per hour more than originally specified . . . 100 tons per hour increase in possible payload at normal elevator capacity. 2: A continuous, automatic, self-leveling system that keeps platform at deck level regardless of load changes. 3: Automatic "fail-safe" system that holds the platform in position if power fails. 4: Single lever speed and direction control. 5: A leak-tight, trouble-free, dependable system in a "grain-tight" housing. Oilgear's business is the engineering and building of the finest, complete systems supplying the power for — and the control of any linear or rotary motion. Oilgear *Application-Engineered Controlled Motion Systems* are simplest to install, operate, and maintain — they're a complete system for a specific application — with one responsibility for that entire system.

Breakaway drawing shows Oilgear Controlled Motion elevator system operating between main and lower decks. Fluid Power from Oilgear "Power-Pak" is piped to two single-acting cylinders (b) mounted vertically from the underside of the spar deck. Controlled Fluid Power forces rams down, bringing elevators up through a simple chain-pulley system. Equalizer shaft (c) keeps elevator platform level at all times. Photo above illustrates the complete ease of unloading platform with two lift trucks operating from opposite sides. During normal loading or unloading operations, 14 or more lift trucks and truck-trains are used to keep pace with the 4 elevators. Photo — right — taken from elevator platform 'tween decks shows operator at the control stand. Continuous, automatic, self-leveling interlock can be seen at arrow (d). Chain-pulley system and equalizer shaft (c) are also clearly visible to side and top.

Other Oilgear marine applications include power and control systems for steering and flanking gear, catapults, hoists, winches, large valve controls, lock and dam gates.

. . . for the lowest cost per year — it's Oilgear!

For similar practical solutions to YOUR rotary or linear drive and control problems, call the factory-trained Oilgear Application-Engineer in your vicinity. Or write, stating your specific requirements, directly to . . .

THE OILGEAR COMPANY

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FLUID POWER LINES

about hydraulics & pneumatics

LADY BUG, LADY BUG . . . Somehow, small children have a way of terrifying those small insects into flying off to check on home and family. Unfortunately, it's harder to convince plant managers of the fire hazard from hydraulic oil.

Most men concerned with hydraulic maintenance are aware of fire-resistant fluids, and much has been written about water-glycol, synthetic, and emulsion types. Temperature ranges, viscosity characteristics, and changeover requirements are easily available. But our survey, reported in this issue, reveals that still more application engineering has to be done for best results with the fluids.

Our purpose in this report was to find out how these fire-resistant fluids are being used in industries where fire hazards are prevalent. We interviewed plant engineers, and designers in seven industries: die casting, automotive, mining, industrial trucks, aluminum, marine, and steel. We asked them about their success and disappointment in using these fluids. We found out what they're using and why. And we learned what improvements they'd like to see. Their experiences can guide others in the same industry toward better use of fire resistant fluid.

PIECE WORK . . . Ford's Lima (Ohio) engine plant is about as automated as you can get. Touring through, we got our fill of huge broaches, long transfer lines, and multiple drills. But one of the best design ideas we saw is described in "*Air Exhaust Nozzle Switches Rotary Actuators.*" It shows how engine rocker arms are machined one-by-one in a simple, air-operated tool.

CLIMB A FLAG POLE . . . That offer worked well for John Michnya of National-U.S. Radiator in Johnstown, Pa. He made it in a letter pleading for a copy of out-of-print *Air and Oil Cylinders* by Elmer Heiser. We published his letter in the September issue. We've just received another letter from Mr. Michnya saying, "I wish to compliment your organization and the tremendous reader response. The excellent cooperative nature was overwhelmingly gratifying in securing a copy, with very many thanks." You're very welcome. Now go climb!

PUSH 'EM UP . . . Transferring parts from one machine operation to another seems easy when you look at the diagram in "*Automate Your Parts Feeding.*" Like every problem, it's simple once you know the answer. Felix Zawaski who authored this article could tell you about plenty of headaches in working out the pneumatic and mechanical systems on this equipment.

Felix Zawaski

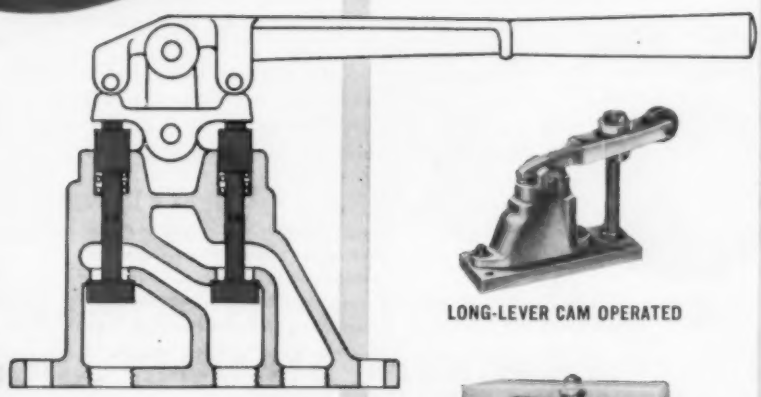
PRESSURE COMPENSATION . . . One of the most versatile components available to hydraulic system designers is the pressure compensated pump. Better understanding of its design can lead to a more efficient system. Walter Ernst, author of a widely used text book on fluid power, discusses its use in "*Design of Pressure-Compensating Controls.*"

Give this valve your *ROUGHEST* jobs!

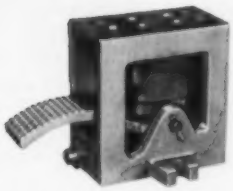
Ross

"100" Series

TOUGH-DUTY VALVE



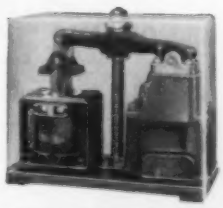
foot, cam, solenoid versions available, too



FOOT OPERATED

ROLLER CAM OPERATED

LONG-LEVER CAM OPERATED



SOLENOID DIRECT OPERATED

Steel mills, foundries, mines, offshore drilling, logging . . . these industries love the Ross "100" Series valve. Here's why: It performs well wherever you need a manually operated valve, but it is really the finest, most dependable valve available for use where the environment is rough and tough. The "100" Series valve will pass most dirt and foreign matter with no trouble and has only a few moving parts. Its poppets travel only a scant fraction of an inch, so it is especially wear resistant. It transmits a "feel" of control to the operator so he may "inch" a cylinder with fine control. Available in locking or non-locking, 3 way or 4 way, closed or cracked-to-exhaust-center models, with handle normally upright or horizontal. Write for further information.

STAY AHEAD MODERNIZE

ROSS OPERATING VALVE COMPANY

105 EAST GOLDEN GATE AVE. • DETROIT 3, MICH.

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BARKSDALE AIR-SEAL* VALVES

LOW PRESSURE AIR TO 250 P.S.I.

. . . over 200 different valves available.

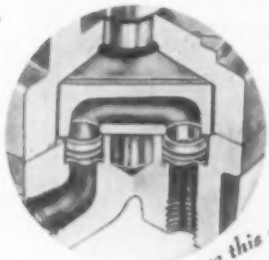
The air pressure is the sealing force . . . the higher the pressure, the tighter the seal.

Why so many different air valves?

Because air valve requirements vary with the method of actuation. A basic valve with interchangeable actuators cannot possibly meet ALL your specific applications without compromise. For example: A solenoid valve designed for speed would not have the stamina required of a manual or foot valve.

The Barksdale line of AIR-SEAL Valves has been designed with your requirements in mind. All our valves have been engineered for best performance from your point of view . . . for YOUR specific need, and not to make OUR job easier.

MANUAL and FOOT OPERATED "SHEAR-SEAL" VALVES



No oilers and filters needed — not critical to dirt and corrosion — made from non-corrosive materials.

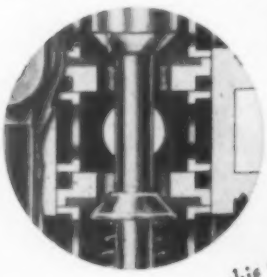
Years of leakproof service — without constant maintenance — Self aligning "Shear-Seal" design compensates for normal wear.

compare this with conventional SPOOL or PLATE VALVES

Alignment is critical — dirt and corrosion cause sticking.

There is no compensation for normal wear — leakage increases with use.

SOLENOID-PILOT CRESCENT® (Self-aligning poppet) VALVES



Quick response (12 milliseconds) due to short travel of poppets and solenoid.

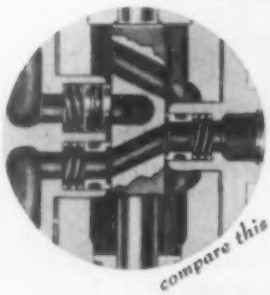
Tight sealing — self-aligning, self-scavenging design adjusts to normal wear — not critical to dirt and corrosion — non-corrosive materials throughout.

No coil burnout — heat dissipating "integral" design.

compare this with conventional SPOOL VALVES

Slower response due to long spool travel. Leakage increases with use — dirt and corrosion particles are ground-in between spool and seals—Sticking! Overheating causes coil burnout — poor heat transfer of "unitized" design.

DIRECT-SOLENOID OPERATED "SHEAR-SEAL" VALVES



Leakproof for years of service — self-adjusting to wear. No coil burnout — because valve does not freeze up.

compare this with conventional SPOOL VALVES

Dirt enters spool clearances — develops leaks — causes sticking — sticky valves are to blame for most solenoid burnout.

Write for Air Valve Catalog Q-AV

CONTROL VALVE DIVISION

Barksdale valves

5125 ALCOA AVENUE • LOS ANGELES 58 • CALIFORNIA

Circle **20** on Time-Saver Card

MANUALLY OPERATED

4-Way valves ¼ to 1½" N.P.T. with or without spring return

Shut-off valves ¼ to 1" N.P.T. with or without spring return

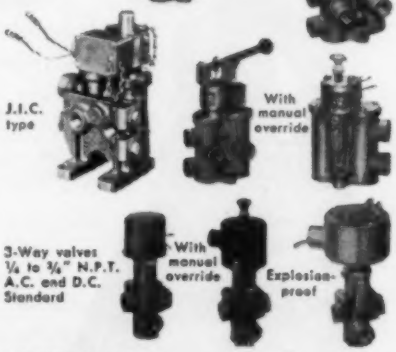
FOOT OPERATED

4-Way valves ¼, ⅜ and ½" N.P.T. with or without spring return

SOLENOID-PILOT

4-Way valves ¼ to ¾" N.P.T. A.C. and D.C. Standard

Explosion-proof



J.I.C. type

With manual override

3-Way valves ¼ to ¾" N.P.T. A.C. and D.C. Standard

With manual override

Explosion-proof

DIRECT SOLENOID

4-Way valves ¼, ⅜ and ½" N.P.T. A.C. and D.C. Standard

Explosion-proof

3-Way valves ¼, ⅜ and ½" N.P.T. A.C. and D.C. Standard

Explosion-proof

Shut-off valves ¼, ⅜ and ½" N.P.T. A.C. and D.C. Standard

Explosion-proof

Diverter valves ¼, ⅜ and ½" N.P.T. A.C. and D.C. Standard

Explosion-proof

Circle 63 ➡

WARNING!

Cutaway drawing of typical hydraulic cylinder. Orange shading indicates packing applications.

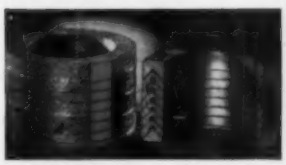
WHEN YOU CHANGE TO A FIRE-RESISTANT HYDRAULIC FLUID, CHANGE PACKINGS, TOO!

Here's why: Many fire-resistant fluids are highly destructive to the common rubbers used for packing mineral base oils.

The Garlock "ORANGE LINE" of packings has been developed specifically, and ONLY, for packing *phosphate ester* type fire-resistant fluids in dynamic applications.

The ORANGE stripe across the packings quickly identifies them as suitable for use against fire-resistant fluids. Butyl Rubber is the base material used in these packings and is *not* compatible with mineral base oils. Therefore the "ORANGE LINE" packings should only be used with the phosphate ester type fire-resistant hydraulic fluids.

*Registered Trademark



Garlock CHEVRON Packing set. Orange stripe quickly identifies packing as suitable for use against fire-resistant fluids.

The Garlock "ORANGE LINE" for fire-resistant hydraulic fluids is available in CHEVRON* Packings, KLOZURE* Oil Seals, Split KLOZURES, U cups, flanges, O-Rings, and other forms of the Garlock 2,000 . . . two thousand different styles of packings, gaskets, and seals to meet *all* your needs. It's the only complete line . . . it's another reason why you get unbiased recommendations from your Garlock representative. Call him today or write for further information on recommended packings for use against fire-resistant hydraulic fluids.

THE GARLOCK PACKING COMPANY, Palmyra, New York

For prompt service, contact one of our 26 sales offices and warehouses throughout the U. S. and Canada

GARLOCK

Packings, Gaskets, Oil Seals, Mechanical Seals, Rubber Expansion Joints, Fluorocarbon Products

How B&W JOB-MATCHED LECTROSONIC* J.I.C. TUBES solve hydraulic fluid line problems

New J.I.C. Standards approve welded carbon steel tubing for hydraulic fluid lines—and B&W makes such tubing—

Five quality control checks—including 100% ultrasonic inspection — help assure you maximum dependability from B&W Job-Matched Lectrosonic J.I.C. Hydraulic Fluid Line Tubing. You get:

- . . . a full range of sizes and dimensional exactness and uniformity — matched to your job in every detail
- . . . controlled mechanical properties — to give ease of fabrication and save you installation time
- . . . long, trouble-free service life — even in the most exacting applications

B&W will be glad to help you select exactly the right tube for efficient, economical service. Call your local B&W District Sales Specialist, or write for Bulletin 435 for full information. The Babcock & Wilcox Company, Tubular Products Division, Beaver Falls, Pennsylvania.

*Welded Carbon Steel Tubing

B&W

THE BABCOCK & WILCOX COMPANY

TUBULAR PRODUCTS DIVISION

TA-9039-WM3

Seamless and welded tubular products, solid extrusions, seamless welding fittings and forged steel flanges—in carbon, alloy and stainless steels and special metals

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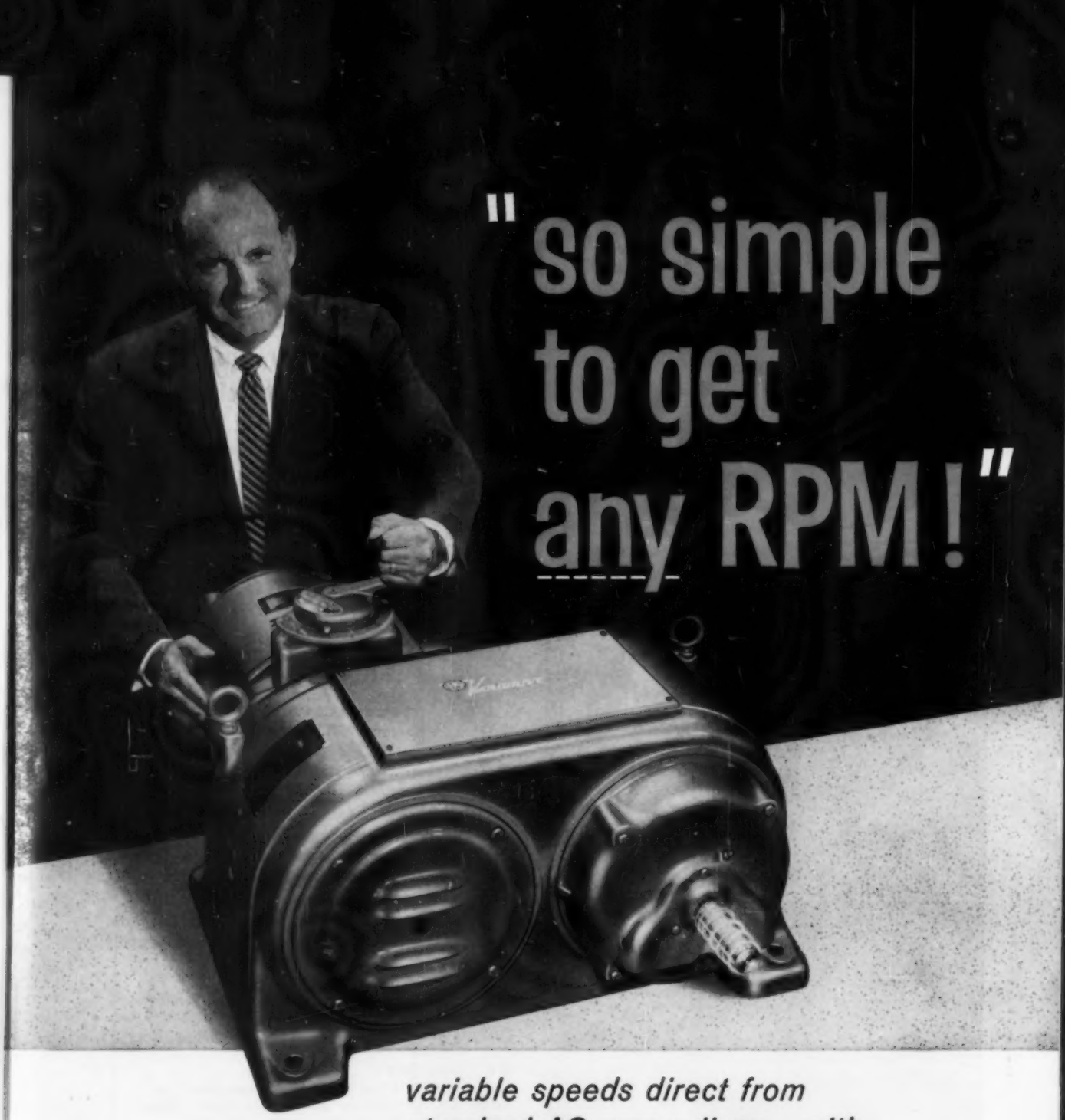
Circle **143** ➡



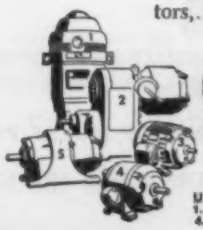
variable speeds direct from standard AC power lines...with

U.S. VARIDRIVE MOTORS

Smooth, stepless speed changes to the split RPM—with the simple, completely self-contained U.S. VARIDRIVE MOTOR! Just plug into any standard AC power line.

Why bother with DC Converter, DC Generators, complicated electronic tubes and circuits that require special technicians? Why risk costly production shutdowns?

You avoid complications when you choose U.S. VARIDRIVE—dependable, simple, easy for ordinary personnel to maintain. Available in RATINGS ¼ TO 75 H.P. Specify: "U.S. VARIDRIVE MOTOR."



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U.S. MAJOR MOTOR LINES INCLUDE:
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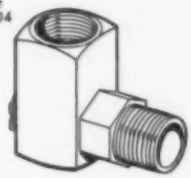
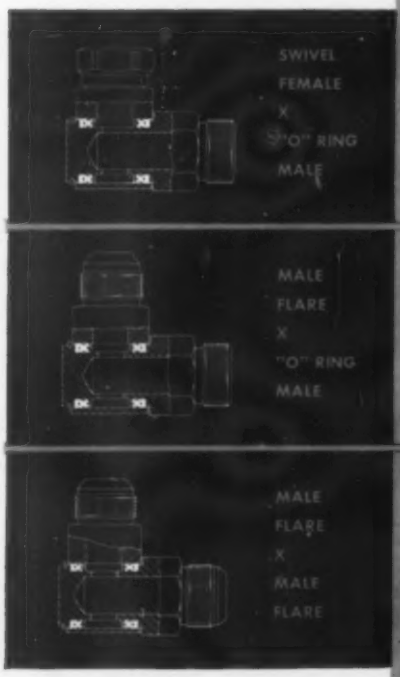
FREE COLOR-ILLUSTRATED BROCHURE
...Send for U.S. Varidrive Bulletin 1797

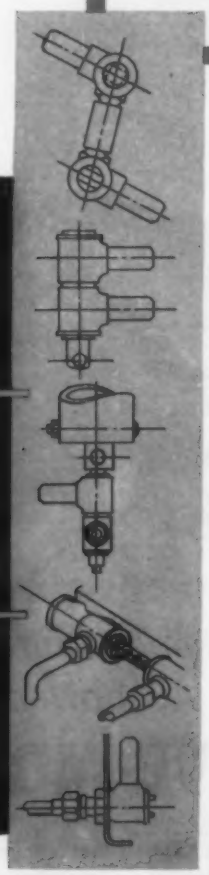
Eastman offers INDUSTRIAL SWIVEL CONNECTOR

to eliminate hydraulic hose failure under severe flexing

Licensed Under Pat. No. 2481404







If you have been designing "around" metal swivel joints because of high cost, EASTMAN now offers an economical swivel connector for industrial use—precision engineered to assure adequate freedom of motion—proved under the most rigid government requirements.

Unique design assures "balanced" flow of hydraulic fluid at required pressure—at any angle. Fluid pressure is also balanced by a ***double seal*** assembly at each end of stem. Pressure-Balance assures equal internal pressure, causing the body to float about the stem, free of end load and friction.

Eastman Swivel connectors will make your flexing installations the most reliable link in your Hydraulic Assembly.

APPLICATIONS:
For use on Cranes, Loaders, Earth Moving Equipment, Hydraulic Presses, Shears, etc.—wherever unusual flexing and exposure may shorten hose life or cause premature failure and frequent replacement.

ECONOMY:
Permits use of shorter hose lengths since less hose allowance is needed for complete extension. Shorter lengths of longer lasting, multiple spiral wire high pressure hose may be used, since Swivel Connector absorbs flexing motion.

ADAPTABILITY:
Body of Connector available with any combination of ends. Now available in types and sizes shown at left. Various combinations of stems can be interchanged with any body style.

WRITE, WIRE or CALL about Eastman Swivel Connector Opportunities in Your Line.

STANDARD SIZES AND COMBINATIONS AVAILABLE

•

LOW TORQUE—Freedom from friction, even under high pressure.

WIDE RANGE—Operating pressures up to 5000 PSI. Trouble-free operation through wide temperature range.

ROTATION—Full 360° for all manifolds.

SIZES—Steel, plated for corrosion protection—½" thru 1½".

Eastman
first in the field MANUFACTURING COMPANY
Dept. AH-11, MANITOWAC, WISCONSIN

SAFEGUARDING AMERICA'S LIFELINES OF MOBILE POWER

LETTERS to the editor

Address your letters to: Editor, APPLIED HYDRAULICS & PNEUMATICS MAGAZINE, 812 Huron Rd., Cleveland 15, Ohio.

Press Safety

TO THE EDITOR:

Between six months and a year ago I read an article in one of your magazines relative to pneumatic control valves for controlling brakes and clutches on presses. As I recall this was a very excellent article on the subject. I passed the article around to several people, and in doing so the article was misplaced.

I would appreciate your air-mailing another copy of this article as I have a design problem now for which this article would aid me immeasurably.

RAY W. WAGNER
Plant Engineer
Bendix Do Brasil
Capinas, SP
Brazil

We believe you are referring to the article, "All-Air Press Safety Circuit" which appeared in July 1957. A copy of the article has been sent.

use the
TIME SAVER CARD
to get more information on any product mentioned in our product reviews, useful literature or advertised in this issue.

Gun Control Systems

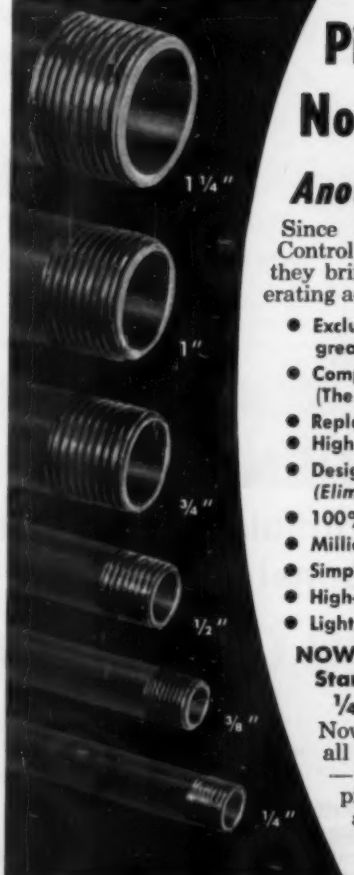
TO THE EDITOR:

The Bendix-Pacific Division of Bendix Aviation Corp. has undertaken a state-of-the-art survey for the Ordnance Tank-Automotive Command. The purpose of this study is to recommend the optimum pressure for use in hydraulic gun control systems. Our hydraulics engineering department is under contract to gather and

Continued on page 18

A NOPAK Plus Value PRODUCT

NOPAK-MATIC



Piston-Poppet Valves Now in 6 Pipe Sizes!

Another Plus Value for You

Since their introduction, Nopak-Matic Control Valves have *proven in service* that they bring you all of the features and operating advantages claimed for them:

- Exclusive "Flow-Director" Pilot Heads for greater versatility
- Complete interchangeability of Pilot Heads (The 3 Pilot Heads fit all models)
- Replaceable self-cleaning seats
- High tolerance to dirty air (not hurt by dirt)
- Designed for Fast Maintenance *(Eliminates costly down time)*
- 100% J.I.C. at no extra cost!
- Millions of trouble-free cycles
- Simplified Piping
- High-speed split-second performance
- Light weight, compact, corrosion resistant

NOW AVAILABLE IN SIX Standard Pipe Sizes from ¼" to 1¼"

Now *all* Nopak-Matic Valves — in all body styles, with all pilot options — are available in the 6 most popular pipe sizes: ¼", ⅜", ½", ¾", 1", and 1¼". Another *Plus Value* by Nopak. Ask your Nopak representative or write.

NOPAK VALVES and CYLINDERS

GALLAND-HENNING NOPAK DIVISION
2743 South 31st Street
Milwaukee 46, Wisconsin

Circle **61** *on Time-Saver Card*

MARVEL
IN-LINE FILTER
CAPACITIES: Up to 60 G.P.M.
PIPE SIZES: ¾"—1"—1¼"—and 1½" (at both inlet and outlet).
BY-PASS VALVE: Available with or without.
Bonded LINE TYPE
CAPACITIES: 10—20—30—50 and 75 G.P.M.
PIPE SIZES: 1"—1¼"—1½"—2" and 2½".
BY-PASS VALVE: Available with or without.
OPERATING PRESSURE: Up to 250 p.s.i.
OPERATING TEMPERATURES up to 300° F.

QUALITY–DEPENDABILITY–EFFICIENCY

A simple formula – but is foremost in the design and construction of all Marvel Filters

–Over 900 O.E.M.s can't be wrong –

Designers and manufacturers of hydraulic equipment requested suction filters incorporating special features.

For example—a by-pass valve to assure instant flow of hydraulic oils on construction and earth moving equipment during cold weather operations. Three of the filters illustrated are available with this important feature.

The Tandem Sump Type Filter supplies the demand for a single unit to handle greater capacity where space limitations present a problem for multiple unit installations.

We are pleased to advise that all units are now stock items and are being supplied to many of over 900 Original Equipment Manufacturers who are installing them as standard equipment.

For Dependable Protection on all Hydraulic and other liquid circulating systems – Investigate MARVEL Synclinal Filters

For further information—write, wire or phone

does it again!

Designers asked for these filters—
MARVEL is delivering them now!

Tandem SUMP TYPE

CAPACITIES: 10—16—20—40—60—100—150 and 200 G.P.M.
PIPE SIZES: ¾"—1"—1¼"—1½"—2"—2½" and 3".
CONNECTIONS: Coupling—Male Nipple.
BY-PASS VALVE: Not available.

Bonded SUMP TYPE

CAPACITIES: 10—20—30—50 and 75 G.P.M.
PIPE SIZES: 1"—1¼"—1½"—2"—and 2½".
CONNECTIONS: Coupling—"O" Ring—Male Nipple.
BY-PASS VALVE: Available with or without.

MARVEL ENGINEERING COMPANY

7227 NORTH HAMLIN AVENUE, CHICAGO 45, ILL. • PHONE: JUniper 8-6023

Please send me information on Marvel Filters as indicated.

- ☐ Sump Type
- ☐ Line Type
- ☐ In-Line
- ☐ Tandem
- ☐ For Hydraulic Oil
- ☐ Fire Resistant Fluids
- ☐ For Coolants or Lubricants
- ☐ For Water

AH-11

*Name*_____

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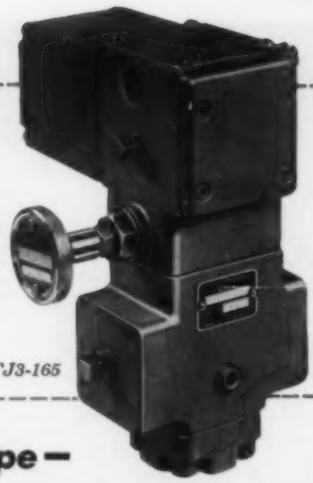


The "J" type adjustable relief valve has an attached solenoid-controlled two-way pilot valve that changes the main valve function from regulating maximum pressure to that of unloading fluid at minimum pressure. Thus, when fluid is not doing work, it can be automatically returned to the reservoir without going over the relief valve and creating costly heat.

Model No. BTJ3-165

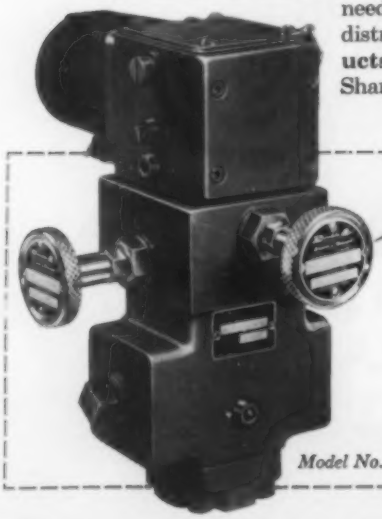
From Brown & Sharpe—

Two Double A Relief Valves *with* Solenoid Controls

They are exclusive with Double A! They are hydraulic relief valves that do more for you:

- An adjustable pressure relief valve with a solenoid control to allow full bypass of fluid at idling pressure.
- A dual pressure relief valve with a solenoid control providing a choice of two individually adjustable maximum pressure settings.

The standard Double A line was designed to meet the circuit requirements of today. You can expect to find exactly what you need. Call your local Double A hydraulic distributor. Or write to **Double A Products Co.,** a subsidiary of Brown & Sharpe Mfg. Co., Manchester, Michigan.



The "D" type relief valve, with dual pressure adjustment controls, has an attached solenoid-controlled two-way pilot valve. Through this control either one of two maximum pressure settings can automatically be made effective. Thus, you can gain control over two levels of pressures (and save power as well) where pressure requirements vary in the course of a work cycle.

Model No. BTD3-175

Brown & Sharpe

HYDRAULICS DIVISION

GEAR, VANE & CENTRIFUGAL PUMPS
DOUBLE A VALVES
GEROTOR PUMPS
POWER UNITS

PROGRESS IN PRECISION FOR OVER 125 YEARS

GET COMPLETE INFORMATION on Double A solenoid-controlled relief valves **ASK FOR** Data Sheet No. 8713

Circle **46** on Time-Saver Card

LETTERS

evaluate information from various sources as a basis for our recommendations.

We would greatly appreciate your suppling us with an index of applicable articles in high pressure hydraulic control systems published in APPLIED HYDRAULICS & PNEUMATICS from 1957 to date.

WILLIAM G. HICKEY
Senior Project Engineer
Pacific Division
Bendix Aviation Corp.
North Hollywood, Calif.

Complete indexes for 1957 and 1958 have been sent.

The Fluid Power Forum

Each month APPLIED HYDRAULICS & PNEUMATICS asks readers for their opinions and experiences in fluid power design.

● *Where do you install filters in hydraulic systems? Have you used high pressure filters in the pump outlet line? Do they have advantages in your designs? What steps have you taken to make hydraulic or pneumatic maintenance easy?*

Normally, the suction strainer furnished with the tank which we buy is adequate for our systems. On one occasion we used a micronic, full flow filter on the pump suction in addition to the strainer, and the results were very good. The filter was rated at 30 gpm, the pump at 18 gpm.

We have recently used a high pressure filter on the pump outlet line, but have not yet had the machine in service. Normally, a high pressure filter is not needed on our machines.

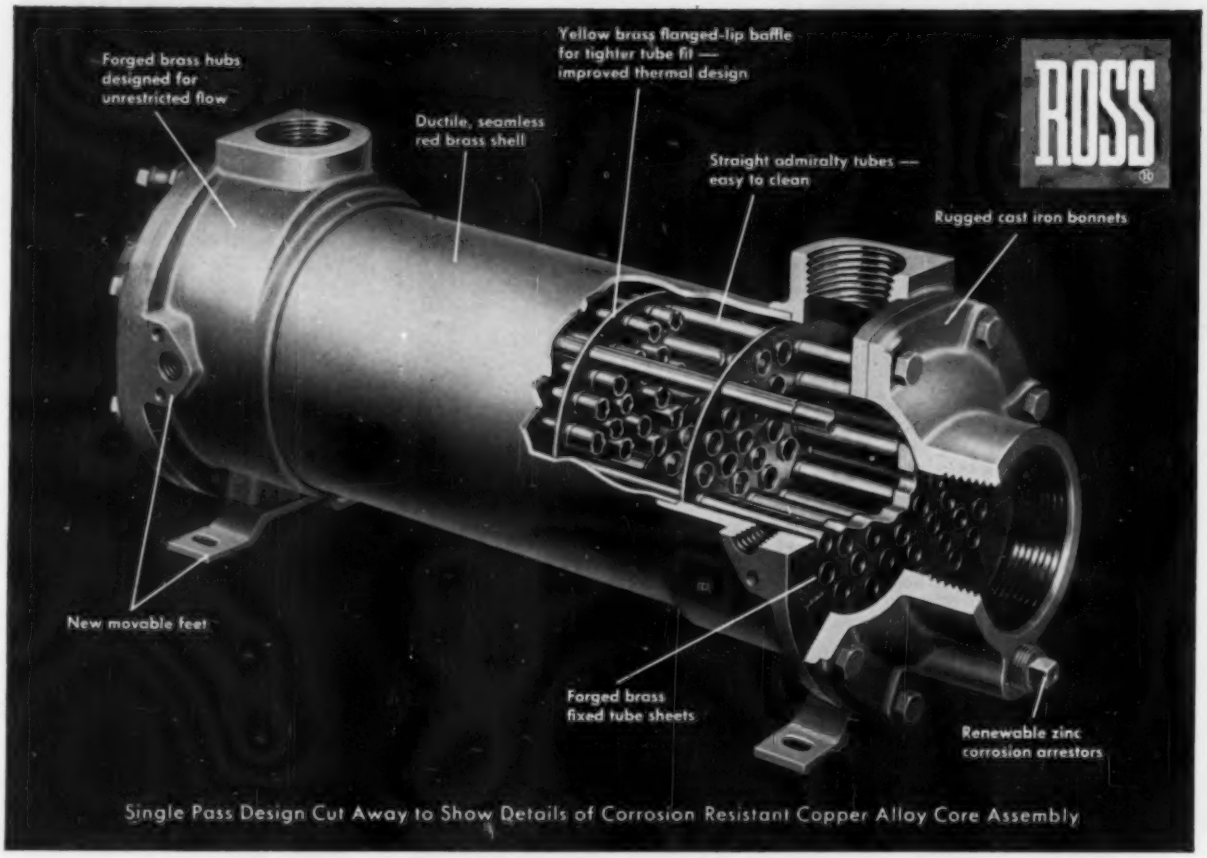
To simplify maintenance, we are building our equipment with panel-mounted valves, using a drilled, steel manifold to reduce assembly time and leakage.

One question which other readers may be able to answer is where can we get a sequence valve with a 3-way or 4-way spool?

L. H. WIRTH
Designer
General Electric Co.
Erie, Pennsylvania

LOOK AT THE LEADER'S LATEST . . .

New design of a famous line . . . Ross BCF Exchangers


Forged brass hubs designed for unrestricted flow
Ductile, seamless red brass shell
Yellow brass flanged-lip baffle for tighter tube fit — improved thermal design
Straight admiralty tubes — easy to clean
Rugged cast iron bonnets
ROSS
New movable feet
Forged brass fixed tube sheets
Renewable zinc corrosion arrestors

Single Pass Design Cut Away to Show Details of Corrosion Resistant Copper Alloy Core Assembly

LOOK AT THE LIST . . . new design features, new sizes, new capacities, new mountings, new materials . . . *new low prices!* The leader and originator of small, compact, fully standardized exchangers takes another step forward.

Ross Heat Exchanger (now part of American-Standard* Industrial Division) originated the whole BCF idea 15 years ago. Before then, pre-engineered design, mass produced parts and stocked assemblies were untried for a unit of this type. Designers and users of original equipment were quick to adopt the BCF as standard. Today, on a larger scale than ever, it is cooling lube oil, jacket water, hydraulic and other fluids for a wide variety of industries.

But, even with such success, the BCF has never been permitted to stand still. Ross has persisted in making constant design refinements and performance improvements . . . *the latest are typical: New* baffles with flanged lip at each tube hole and around outer edge for tighter fit and improved thermal characteristics. *New* stamped steel feet, movable in three positions around hubs for easy, more adaptable mounting. *New* sizes and capacities . . . 46 models . . . one, two or four pass designs . . . giving greater selection than ever before.

Look at the leader's latest. Send in the coupon below for the new Ross Bulletin . . . an up-to-date run down on the new Ross Type BCF Exchanger.

Mail this coupon for new Ross Bulletin

To: American-Standard
Industrial Division
Detroit 32, Mich.

Please send, without obligation, your new Bulletin 1.1K6 describing the new Ross Type BCF Heat Exchanger.

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TITLE _____

COMPANY _____

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Circle **10** *on Time-Saver Card*

Precision has the answer

Precision chemists have developed more than 400 "O" Ring compounds for industry. One of these is **the right one** for your product. It is **the one** which (1) seals the fluid or gas without loss of vitality, (2) has low compression set, correct tensile properties and severe aging resistance and (3) is properly engineered for your product. Precision can supply you with the **right** "O" Ring produced by manufacturing techniques which assure highest quality. The **right** "O" Ring will **save** you money because it will cost **less** per hour of service life.

A Precision Sales Engineer can help you obtain the **right** product design, then recommend the **right** "O" Ring for your job. Write, phone or wire for his services today.

Specify Precision—first in Quality

Precision Rubber Products Corporation • "O" Ring and Dyna-seal Specialists

Dept. 1, Oakridge Drive, Dayton 7, Ohio Canadian plant at: Ste. Thérèse de Blainville, Québec

Circle **116** *on Time-Saver Card*

FUTURE EVENTS

November 16-20
ASME Automation Show & Conference on Material Handling
Trade Show Building
New York, N.Y.

November 17-20
Packaging Machinery Manufacturers Institute Show
New York Coliseum
New York, N.Y.

November 29-December 4
ASME Annual Meeting
Chalfonte-Haddon Hall
Atlantic City, N.J.

December 11
Association of Lift Truck & Portable Elevator Manufacturers
Roosevelt Hotel
New York, N.Y.

December 13-16
Annual Meeting
The Material Handling Institute, Inc.
Savoy-Hilton Hotel
New York, N.Y.

January 11-15
SAE Annual Meeting
Sheraton-Cadillac & Statler Hilton Hotels
Detroit, Mich.

January 25-28
Plant Maintenance & Engineering Show
Convention Hall
Philadelphia, Pa.

May 9-11
National Fluid Power Association Spring Meeting
Grand Hotel
Point Clear, Alabama.

JANUARY 1960

4th annual DESIGNERS GUIDE

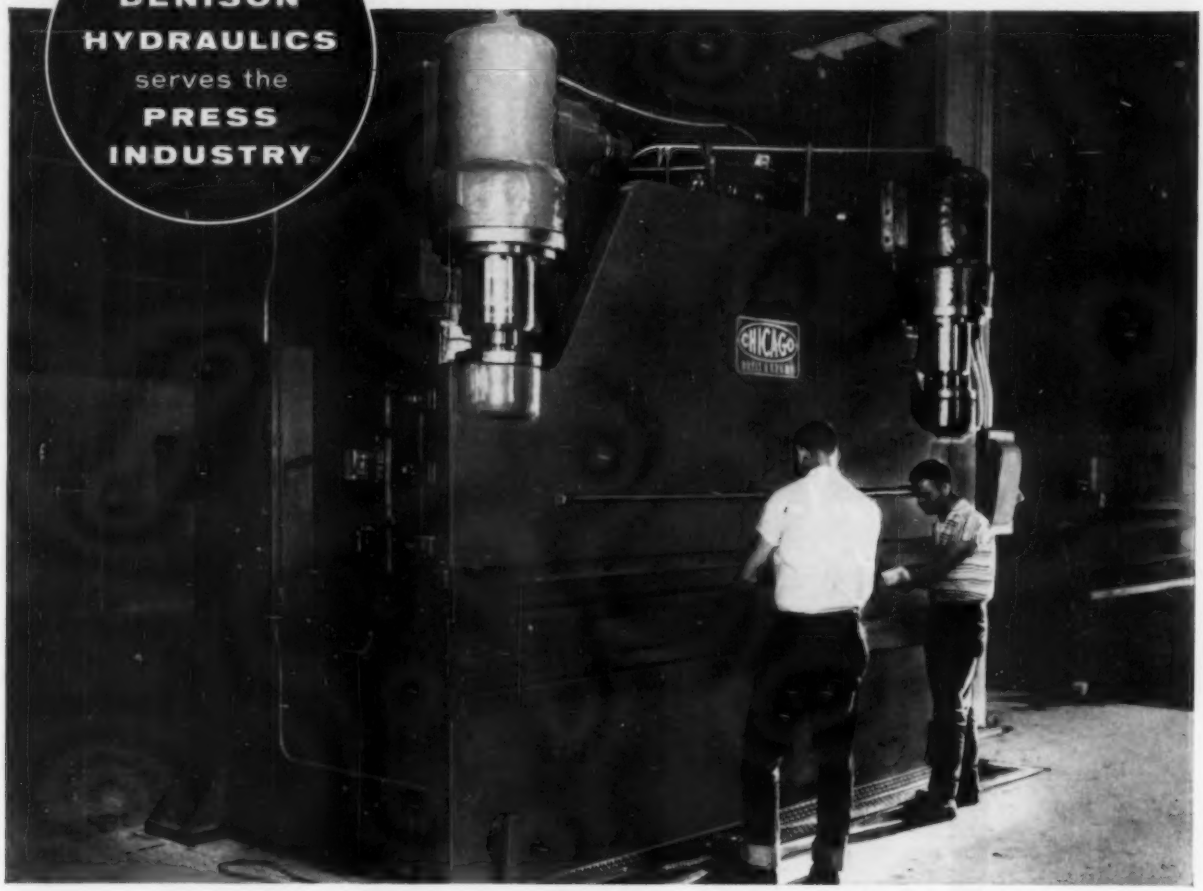
100 pages specification charts
Review of fluid power products

order extra copies $1.00 from

APPLIED HYDRAULICS & PNEUMATICS
812 Huron Rd. • Cleveland 15, Ohio

How **DENISON HYDRAULICS** serves the **PRESS INDUSTRY**

CHICAGO STEEL HYDRAULIC PRESS BRAKE, *14" bending length, Model 300-HF-12. The unit was built by Dreis & Krump and utilizes 3,000 psi hydraulic system, incorporating Denison axial piston and vane-type pumps.*

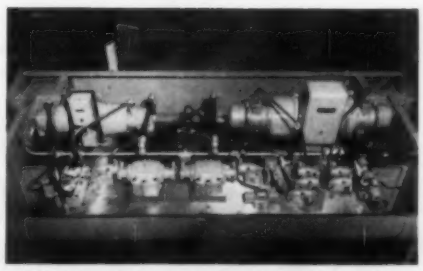


How this **DENISON** 3,000 psi hydraulic system works for **DREIS & KRUMP**

This hydraulic press brake—built by Dreis & Krump Manufacturing Company of Chicago, Illinois—has multiple speed control, rapid approach and return, slow pressing speed for full-tonnage work. Control is attained through a hydraulic system utilizing Denison axial piston pumps, vane-type pumps and hydraulic controls.

In addition, a level control operated by a servo system compensates for any differential in travel of either cylinder to maintain accurate parallel of the ram with the bed. Tonnage control enables the operator to pre-select pressures over the full tonnage range to assure maximum production to dies and work pieces.

Simple in design, the system affords maximum versatility and reliability. Your Denison representative, a specialist in hydraulics, will gladly help in applying the best possible system to your hydraulic machining. Call him.



HYDRAULIC COMPONENTS *for 3,000 psi system for regulating speed and pressure of ram travel.*

DENISON ENGINEERING DIVISION
American Brake Shoe Co.
1166 Dublin Road • Columbus 16, Ohio

Denison Stocking Branch Offices: CHICAGO • DETROIT
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HYDRAULIC PRESSES • PUMPS • MOTORS • CONTROLS

Circle **43** *on Time-Saver Card*

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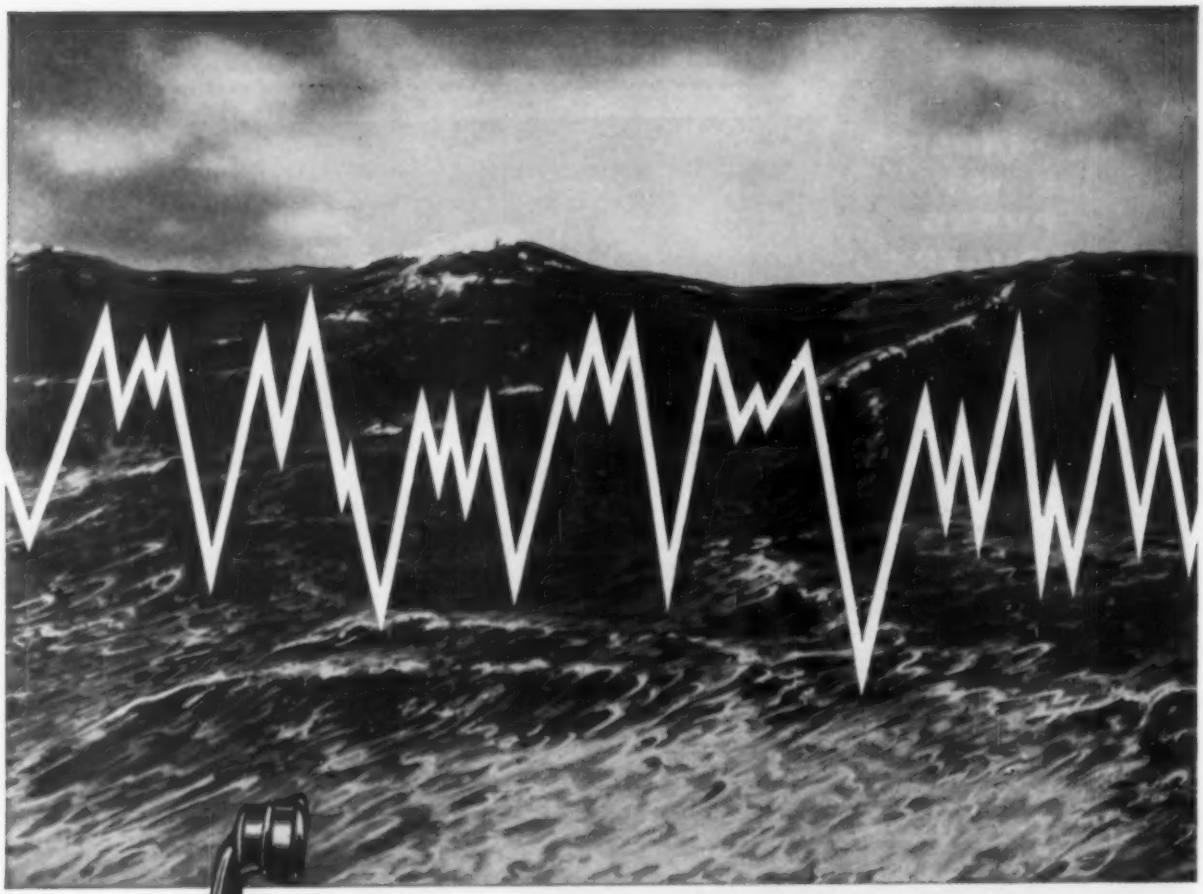
DENISON HydrOILics



Telecommunications

Two recent major steps in the improvement of world telecommunications have been the laying of the first Trans-Atlantic and the California—Hawaii submarine telephone cables.

When laying cable either on a flat sea bed or over underwater mountain ranges, the exact control of paying out speed and tension in the cable is of paramount importance. 'VSG' variable delivery oil hydraulic pumps are used to act as brakes on the cable, which is drawn out of the ship by its own weight. This enables a very smooth and regulated control to be maintained or instantly varied to suit ship speed, paying out speed and tension in the cable.

It is just another of the highly varied applications of 'VSG' variable delivery pumps and transmission gears which have now been serving modern industry for fifty years.

'VSG'

Regd Trade Mark

SERVING MODERN INDUSTRY

VICKERS ARMSTRONGS (ENGINEERS) LTD VICKERS HOUSE BROADWAY LONDON SW1

For every industrial and automotive application... the complete line of non-skive

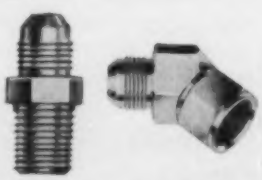
ALEMITE SURGEPRUF®

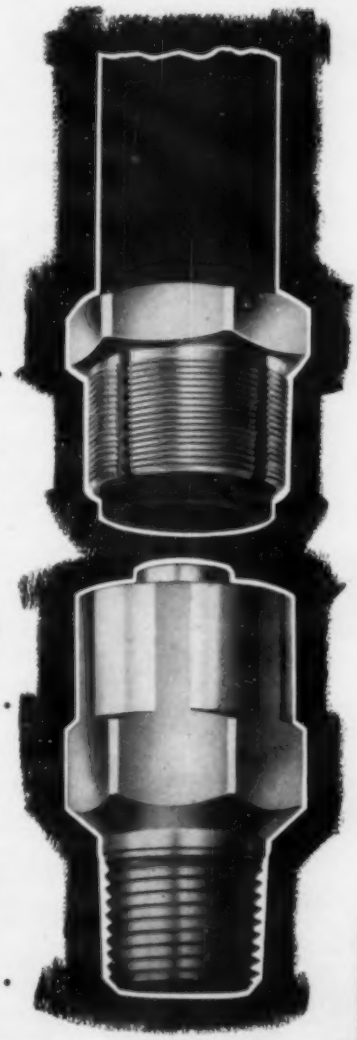
Couplings. Made of high-strength steel, dichromate plated. "Double-wedge grip" forces coupling threads through rubber cover . . . grips either single- or double-wire braid firmly. Saves both time and labor!

Medium-high and high-pressure hose and reusable couplings. Single and double wire braid hose. Non-skive feature assures fast, easy assemblies. Seamless inner tube of Buna-N rubber and Neoprene outer cover. Resists abrasion, weather and oil. No special tools required.

New Low-Pressure "Shur-Lock" Hose. For use on fuel, filter, oil, air and vacuum gauge lines. Rugged, precision-matched couplings. Leak-proof grip.

Adapters and swivel adapters. Full range of sizes in J.I.C. and other threads. One-piece adapters—and swivel union adapters to simplify assembly and avoid twisting strain in cramped quarters.





REUSABLE COUPLINGS AND HYDRAULIC HOSE

Distributed nationally for immediate delivery, Alemite Surgepruf Hose and Couplings are preferred for either fast, easy on-the-job replacement or quality original equipment use. For temperature operating range of −40° to +275°F. Couplings are reusable. Complete range of sizes in hose, couplings, adapters and swivel adapters.

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Circle **7** *on Time-Saver Card*

BRIEFS

about fluid power

WHAT'S NEW FOR THE MOBILE FIELD?

MILWAUKEE: AH&P's editor toured the recent National Farm Construction & Industrial Machinery Display to report these new developments in fluid power components and systems:

NEW GEAR PUMPS . . . Borg Warner's Wooster Division has a new family of gear pumps. Called the P2 Series, these pressure-compensated pumps offer a range of 1.7 to 7.8 gpm at 2000 rpm. Rated pressure is 2000 psi.

HYDRAULIC VIBRATOR . . . Here's a new, simple, portable package that offers a number of application ideas. The model displayed at the Dynex booth had a 2-piston pump powering an actuator at 30 cycles per sec with a ⅞ inch stroke. No valves are used. Entire control is with the pump. Speed of pump determines cycle of actuator.

SMALL PUMPS & MOTORS . . . A new addition to the Dowty pumps and motors being marketed by Berry Hydraulics is the GPO series. This tiny gear pump has a 2 inch square envelope. It delivers .78 gpm at 1800 rpm, 2000 psi. Just right for such jobs as windshield wiper drives. It's pressure balanced.

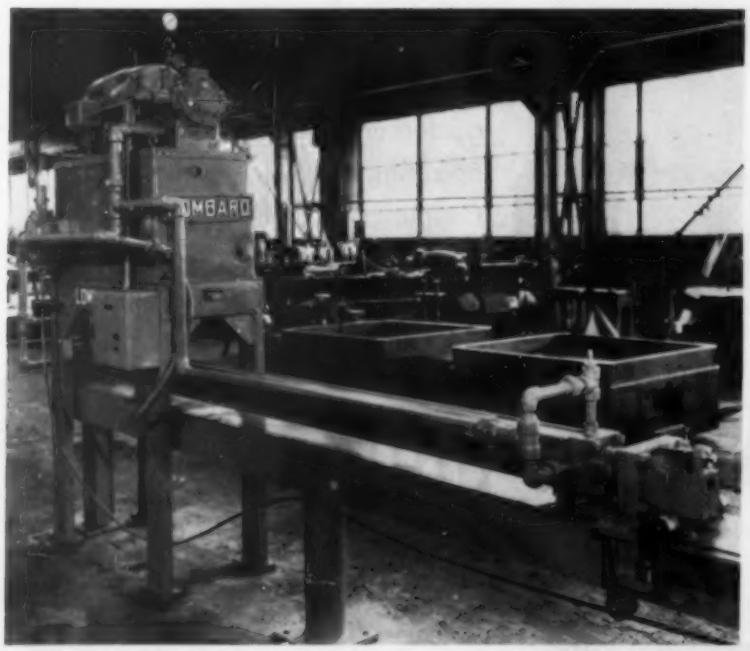
POWER STEERING . . . New units introduced by Vickers simplify the line and reduce cost. Built for 2000 psi. Welded design replaces 1200-psi, tie-rod construction. One valve is now used for all four cylinder sizes. It can be mounted separately or integrally with power cylinder. Valve will handle 20 gpm. Changing spools will reduce flow. This series of steering units will handle axle loads from 1500 to 130,000 pounds.

MINIATURE HYDRAULICS . . . Electric Auto-Lite displayed three sizes of cylindrically shaped, solenoid operated, 2-way, N.C. valves. The smallest, about ¼-inch diameter, 1½-inch long handles 40 cipm. Next size handles one gpm. The largest size approximately 1-inch O.D. and 3 inches long controls 8 to 10 gpm. A single-acting piston pump, complete with motor and reservoir delivers 15 cipm at 2000 psi. This company also has a piston type accumulator—3-inch bore in lengths to deliver 40, 60 or 80 cubic inches.

ORBIT MOTORS . . . Here's a new concept in fluid motor operation. It allows low speed operation

Continued on page 26

CYLINDER DRIVES VARIABLE SPEED DRAW BENCH



A hydraulic cylinder drives this 5-ton draw bench. It is designed for plug and bar drawing of seamless and welded stainless and alloy steel tubing ¼-inch to ½-inch dia. A hydraulic cylinder drive gives maximum flexibility at low cost and permits adjustment of draw and return speed from 0 to 75 fpm. Made by Lombard Corporation, Youngstown, Ohio. □□□

Circle 79 ➡

after years of trouble free service

...Downtime—30 seconds with

HUNT'S *NEW* PDQ VALVE

You asked for a TOTALLY ACCESSIBLE air control valve

We built it. It took us three years designing, field testing, redesigning. Here it is . . . the PDQ. The day (years in the future) when you have to change valves, if it's a Hunt PDQ, you do three things: (A) just loosen 2 cap screws; (B) twist pilot cap; (C) remove pilot cap and valve housing. No pipe to pull. No electrical splices to sever. No junction boxes to open. No electrical conduit to remove. It's plug-in.

Total downtime? I've replaced this valve myself in less than 30 seconds. You buy **trouble-free performance** and **minimum downtime**. I sell **trouble-free performance** and a **new minimum downtime record**. Write today.

N. C. HUNT, PRESIDENT

HUNT VALVE COMPANY · SALEM, OHIO, U. S. A.

- ☑ Accessibility
- ☐ Simplicity
- ☐ Speed and Capacity
- ☐ Price and Quality

The Hunt PDQ Valve tops them all in every class.

Next month . . . the SIMPLICITY story.

HUNT HVC ***Quick-As-Wink*** AIR & HYDRAULIC CONTROL VALVES

BUILD ON... Eastern

HYDRAULIC EXPERIENCE:

GEAR PUMPS and FLUID MOTORS

129 hydraulic pump and electric motor combinations are available off-the-shelf, for most applications. Outside this broad range, specific customer requirements can be met by drawing on Eastern's vast design resources.

All standard Eastern gear pumps are low in cost, light in weight, compact and reliable. Unique design features and very close tolerances enable each unit to achieve high volumetric efficiencies.

Check the performance ranges in these three major groups – do they meet your needs?

1200 series – up to 1.6 G.P.M. – pressures to 800 P.S.I.

100 series – up to 5 G.P.M. – pressures to 1500 P.S.I.

700 series – up to 9.8 G.P.M. – pressures to 1500 P.S.I.

In addition to these pumps, Eastern also produces a wide range of fluid motors, each capable of delivering a constant torque over a very wide speed range. They provide up to 14.5 ft. lbs. of torque at 1750 R.P.M. For full information on any one of these pumps, pump-and-motor combinations, or fluid motors, consult the Eastern sales engineer – or write for bulletin 810-N.

Eastern designs and builds

positive displacement pumps • gear pumps • centrifugal pumps

EASTERN INDUSTRIES INCORPORATED

100 SKIFF STREET
HAMDEN 14, CONN.

EASTERN INDUSTRIES PUMP DIVISION

Circle **50** on Time-Saver Card

BRIEFS

—down to 10 rpm—without gearing. Torques to 283 in-lbs at 100 psi. Other sizes to give up to 1400 in-lbs at 100 psi are being prepared for production. Introduced by Char-Lynn, the design uses Gerotor elements. Outer ring is held stationary. Resulting action is an orbital motion.

Orbitrol is Char-Lynn's new steering system which uses one of these orbiting elements as a sensing device which is coupled directly to the steering wheel. It replaces entire mechanical steering system.

NEW PORT SEAL . . . Dura-Tite is The Imperial Brass Mfg. Co.'s solution to the port sealing problem. It uses a lock nut with a tubular portion at its base. A reinforced, polyamide (nylon) ring inserted between tubular section of nut and the fitting groove provides the primary seal. Secondary seal is metal-to-metal. Standard SAE straight-thread port is used. Joint withstands pressures of 10,000 psi.

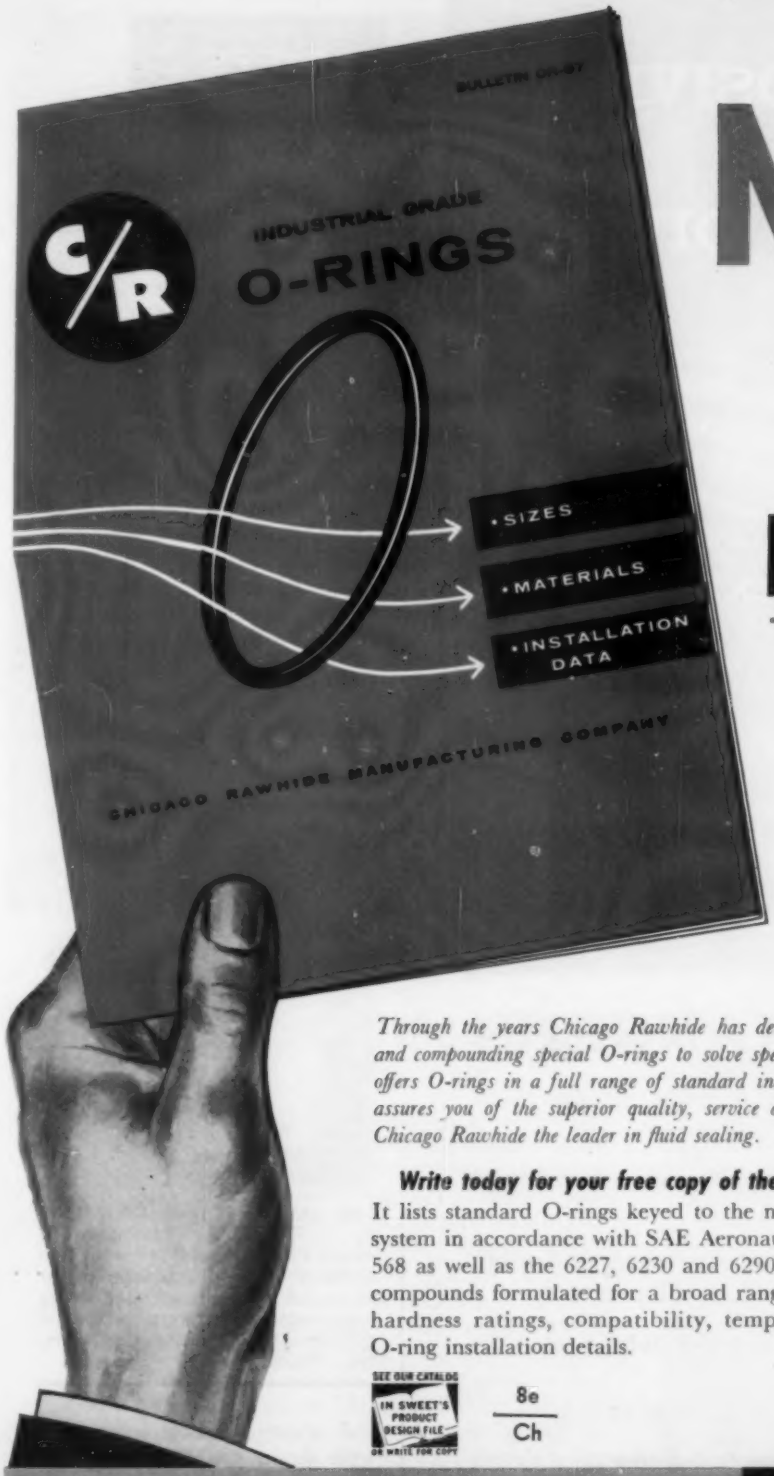
STACK VALVE . . . Webster Electric showed a 2-spool valve which has the add-on stack feature. This design of multiple directional control valves for mobile applications was made to offer economy and flexibility.

PUMPS, MOTORS & VALVES . . . A full line of gear pumps being manufactured by the new Hydraulic Products Div. of Clark Equipment Co. was displayed. In development are fluid motors and valves.

LOW COST PV PUMP . . . Lake Shore Div. of Bendix Aviation showed a pressure-compensated, 2400-psi, 13-gpm at 4000 rpm, axial piston pump. It's performed well on a 2000-hour continuous life test. They say it will carry a price tag of under $75. Offers some real possibilities for a low cost hydrostatic drive.

FLUID LINE FLEXIBILITY . . . Anchor Coupling Company's dis-

Continued on page 28



NOW!

C/R Industrial O-Rings

in Standard Sizes and Compounds

Through the years Chicago Rawhide has developed a reputation for designing and compounding special O-rings to solve special sealing problems. Now, C/R offers O-rings in a full range of standard industrial sizes and compounds, and assures you of the superior quality, service and dependability that have made Chicago Rawhide the leader in fluid sealing.

Write today for your free copy of the new C/R O-Ring Bulletin.
It lists standard O-rings keyed to the new, uniform dash numbering system in accordance with SAE Aeronautical Recommended Practice 568 as well as the 6227, 6230 and 6290 series sizes. It also lists C/R compounds formulated for a broad range of industrial purposes with hardness ratings, compatibility, temperature ranges, and typical O-ring installation details.

SEE OUR CATALOG IN SWEET'S PRODUCT DESIGN FILE OR WRITE FOR COPY

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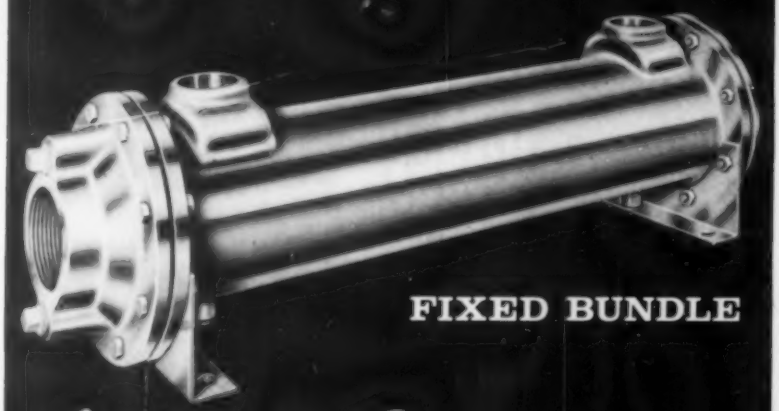
CHICAGO RAWHIDE MANUFACTURING COMPANY
1203 ELSTON AVENUE • CHICAGO 22, ILLINOIS
Offices in 55 principal cities. See your telephone book.
OTHER C/R PRODUCTS: C/R Shaft and End Face Seals • Sirvene (synthetic rubber) molded pliable parts • Sirvis-Conpor mechanical leather cups, packings, boots • C/R Non-Metallic Gears

O-RING C/R DIVISION
CHICAGO RAWHIDE

FOR CORROSIVE TYPES OF HYDRAULIC OILS . . .



FIXED BUNDLE

Yates-American

STAINLESS STEEL

HEAT EXCHANGERS

- Stainless Steel Construction . . . all parts in contact with fluids . . . of Type 316 stainless steel.
- Rolled tube joints . . . industry's preference and standard of quality construction.
- Tube pattern . . . allows for use of wider, heavier gaskets for critical conditions of temperature and pressure.
- Wider range of capacity . . . $\frac{1}{4}$" and $\frac{3}{8}$" tube sizes . . . unit sizes 2" to 10" diameter.

WRITE FOR BULLETIN HT-21

Over 75 years of service to industry

HEAT TRANSFER DIVISION

Yates-American

MACHINE COMPANY

705 4th St. BELOIT, WISCONSIN

HEAT EXCHANGERS / RADIATORS / AFTERCOOLERS

Circle **157** *on Time-Saver Card*

BRIEFS

play emphasized a new line of 3000-psi, weld type fittings designed to allow pipe or tube assemblies to be made from a single length of tube and bent to any desired shape. This is one more step toward the elimination of troublesome pipe threads.

IN-LINE FILTER . . . Now available in sizes to 50 gpm, Marvel Engineering showed their in-line suction filter. Designed for hydraulic systems on front-end loaders, back hoes, etc. where the machine structure is used for the oil reservoir. Body is die cast. Standard screen is 100 mesh; it's available with a by-pass valve.

THREE-CIRCUIT SWIVEL . . . Crane builders who must carry hydraulic fluid between a fixed and rotating machine member were shown a 6000-psi swivel by Formrite. It's designed for jobs where relative motion is slow, and where a full, 360-degree swing may take place.

TWO DOUBLE-ACTING CYLINDERS tip bulk handling containers to empty them. The unit is mobile and contains its own hydraulic power supply. A manually-operated 4-way valve extends and retracts the tilt cylinders. Made by Essex Conveyors, Inc., Nutley, N.Y.

HIGH PRESSURE GAUGES . . . The first, direct acting, high pressure gauge where the pointer is directly connected to the pressure

Continued on page 32

DYNAMIC DIFFERENCE
in hydraulic performance

Webster
DIRECTIONAL CONTROL VALVES

Combines to culvert cleaners — anywhere one, two or more hydraulic applications are handled at one time... *the difference is dynamically apparent when Webster is on the job!* Versatile! Parallel design permits control of up to 6 independent circuits. Range! Operating pressures to 2000 psi — shock pressures to 5000 psi. Lowest back pressure. Compact! Smallest size for rating. Three sizes — single spool type in 20 gpm capacity, parallel stacked in 20 and 40 gpm capacities.

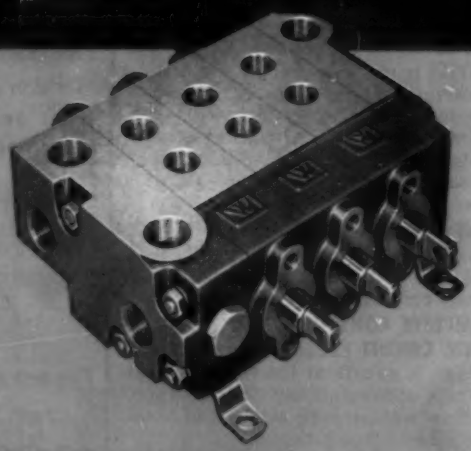
You find Webster Directional Control Valves on leading agricultural, road building and industrial machines. Chances are there's a size and model ideally suited for your product — for the dynamic difference that pays!

OIL HYDRAULICS DIVISION

WEBSTER ELECTRIC

RACINE · WIS

our 50th year



DESIGNED FOR PEAK PERFORMANCE

- Alloy steel spools — heat-treated, precision-ground.
- Fully balanced at all pressures.
- Stack valves have throttling grooves in spools for smooth, gradual flow.
- Inlet and outlet connections can be made to the same end of the valve assembly to simplify hook up.
- Alternate porting positions provided for flexibility in application.

Call the man from Webster

... he's one of a staff of engineers, specially trained in hydraulic application. He can help you solve special problems when hydraulics become a part of your design!

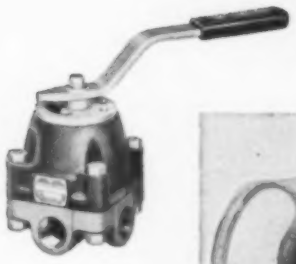
BULLETIN HY11 gives complete performance and installation data

For High Pressure (to 6000 P.S.I.)

MANUAL WATER VALVES

that last

Specify "SHEAR-SEAL" design



4-Way, Manipulator, Dual pressure and Shut-off Valves from ¼ to 1½" N.P.T.

Note the mirrorlike sealing surfaces on this Dual Pressure Valve rotor after 4 years of service.

On extrusion presses, die casting machines, rubber and plastic molding presses and on blowout preventers, they have performed without maintenance longer than any other type of valve.

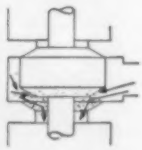
This LONG, MAINTENANCE-FREE SERVICE is possible because the metal-to-metal sealing surfaces are self-aligning and actually improve with use through continued lapping action. Sealing qualities do not diminish because a spring compensates for the wear.

DIRT CANNOT SCORE SEALS because flow is through "Shear-Seals," sealing surfaces remain in constant intimate contact.

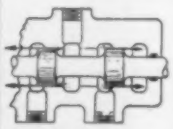
COMPLETE CONTROL OF YOUR CIRCUIT because "Shear-Seal" design is excellent for throttling. It permits opening to any desired degree of flow with smooth action and without fighting fluid pressure.

The "Shear-Seal" action eliminates line surges and the round tubular flow passages provide more flow and velocity capacity (up to 60 ft. per sec.) because they are unobstructed by spools or poppets.

This is why we don't use **SPOOL OR POPPET DESIGN**



Poppets score



Spools leak

Write for Catalog V-59-60

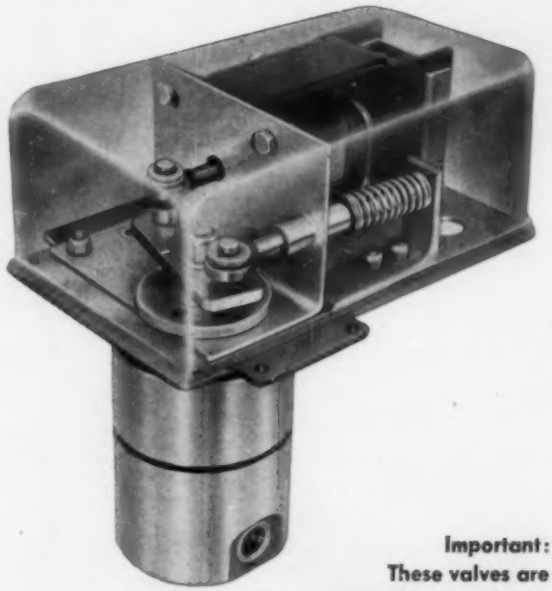
CONTROL VALVE DIVISION

barksdale valves

5125 ALCOA AVENUE • LOS ANGELES 58 • CALIFORNIA

Circle **22** *on Time-Saver Card*

10,000 P.S.I. SOLENOID VALVES



Important: These valves are standard catalog items.

● They are available for immediate delivery (in stock) at standard valve prices, for a service which generally requires costly (made-to-order) special valves.

● Shut off and 4-way valves in ¼, ⅜ and ½ inch port sizes are rated for 10,000 P.S.I. liquid or gases. They will withstand surges of up to 15,000 P.S.I. without damage to the valves' sealing qualities (designed for a burst pressure of 30,000 P.S.I.).

Solenoids are available for 115, 230 and 460 volt A.C. operation.

● Long maintenance-free service is achieved through the leak-proof "Shear-Seal" design. Optically flat metal to metal sealing surfaces (of the self-aligning sealing rings and the mating rotor face) are protected by staying in constant intimate contact: flow is always through the center of the "Shear-Seals," never across sealing surfaces. Sealing qualities actually improve as the seals lap themselves to a more perfect fit with each valve operation. There is no external shaft leakage because the pressure is confined to the flow passages.

For complete data write for catalog S-10000.

CONTROL VALVE DIVISION

barksdale valves

5125 ALCOA AVENUE • LOS ANGELES 58 • CALIFORNIA

Circle **23** *on Time-Saver Card*

here's a 3-POINT PROGRAM for lower cylinder costs

1

2

3

Cut inventory costs

to a minimum by taking advantage of fast deliveries from Hydro-Line factory stocks. Over 90% of all cylinder applications fall into the thousands of bore, stroke and cushion combinations ready for immediate shipment. Series R2 cylinders rated at 200 psi air and 500-2500 psi hydraulic; Series S2 cylinders rated at 200 psi air and 1000 psi hydraulic; Series N cylinders rated at 2000 psi and higher.

Pare maintenance costs

by taking advantage of the cylinders that not only require fewer downtime periods in every class of service, but also are faster and easier to service on the job without special tools or equipment.

Save 42-1/2% by specifying R2 Series

Specifying this design instead of high-pressure hydraulic cylinders will give you these, or even greater, savings. You can save even more by specifying stock cylinders. By choosing Hydro-Line you can eliminate specials on almost all jobs. All three series — R2, N, and S2 — meet J I C specifications.

Just fill in the coupon below to get bulletins containing more data or contact your nearby Hydro-Line representative.

HL HYDRO-LINE CYLINDERS

5601 PIKE ROAD • ROCKFORD, ILLINOIS

manufacturers of: high- and low-pressure hydraulic cylinders • heavy-duty air cylinders • adjustable-stroke cylinders • dispensing cylinders • intensifiers • single-acting cylinders • booster cylinders

Circle **85** *on Time-Saver Card*

act now!

Please send me additional data on the classes of Hydro-Line cylinders checked below, including complete information on deliveries from factory stocks:

( ) Series R2 (heavy-duty air, medium-duty hydraulic, industry standard)
( ) Series N (heavy-duty hydraulic, industry standard)
( ) Series S2 (automotive industry automation standards)

Name and Title _____
Company _____
City _____ State _____

HYDRO-LINE MANUFACTURING COMPANY
5601 PIKE ROAD ROCKFORD, ILLINOIS

NUGENT

offers something *Unique* in strainers

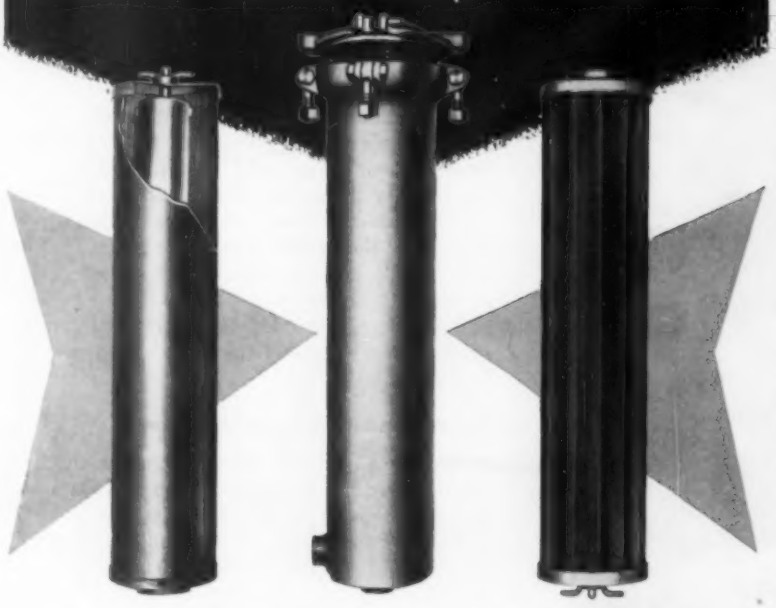


Figure 1554A-4L strainer basket available in brass, steel or stainless steel screen. 8 x 8 to 100 x 100 mesh.

Figure 1554-4L and Figure 1490DD-4L strainer shells are identical. Strainer baskets shown are interchangeable in this model.

Figure 1490CN-4L basket. Star-shape provides 20% more free screen area in this size. Available same metals, mesh as Fig. 1554A.

Nugent pipe line strainers can materially reduce your maintenance labor costs and hold down-time to a minimum. Unlike most strainers of this type, both the Nugent round basket and star-shaped extended area strainers, shown above, catch and hold their accumulation of foreign solids in the interior of the strainer basket.

Dirty liquid, under pressure, enters the strainer through the bottom inlet. It is then propelled upward through the center tube assembly. Emerging at the top, the liquid travels outward and downward, through the mesh of the basket and to the side outlet. In this manner, foreign solids are trapped *inside* the strainer basket which is then easily lifted from the outer shell for cleaning. A clean spare basket may be immediately substituted and the dirty basket cleaned when convenient.

Most other strainers direct the flow of dirty liquid from the exterior to the interior of the basket. Thus, foreign matter is trapped between the outer shell and the basket; not inside. When these dirty baskets are removed for cleaning, it is almost impossible to prevent some foreign matter from flowing back to the inlet and outlet piping. This type also requires scraping and cleaning the interior of the outer shell, a time consuming task that increases down-time.

Nugent strainers can save you time and money. For full details write for Bulletin 6.

ESTABLISHED 1897

WM. W. NUGENT & CO., INC.

3462 CLEVELAND STREET, SKOKIE, ILLINOIS

REPRESENTATIVES IN PRINCIPAL CITIES

OIL FILTERS • STRAINERS • TELESCOPIC OILERS
OILING AND FILTERING SYSTEMS • OILING DEVICES
SIGHT FEED VALVES • FLOW INDICATORS

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BRIEFS

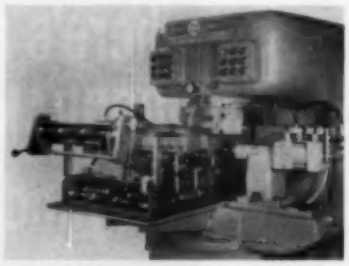
element without linkage or bearings and with no gears or hair springs was shown by Rochester Mfg. Co. The pressure element is a multiple turn bourdon coil. The end of the coil rotates as the pressure increases to give a full 270-degree dial indication without additional linkage or gearing.

HYDRAULIC FUSES . . . Among the group of pressure, flow and directional valves displayed by Waterman Engineering were their hydraulic fuses. Developed originally for airborne use, these fuses offer an important safety feature for many ground equipment applications. The fuse acts to close a line if a failure occurs downstream. □ □ □

Air plays important part on automatic loader

A slide-type fully automatic loader for handling long, slender parts features an air-cushioned exit motion and an air-powered steady rest.

Parts such as automotive camshafts are loaded into the inlet



magazine in the loader and pass through a pair of gaging master gears to check for any oversize condition of the gear to be shaved or honed.

In the inlet magazine, gears are spaced apart by a series of linkages that automatically advance each shaft part. Air-powered head and tail stocks center into each shaft end in the meshing position.

When a part is in finishing position in mesh with the gear-shaped tool, an air-powered steady

Continued on page 36

For Cylinders Circle **73** ➡
For Fittings Circle **110** ➡

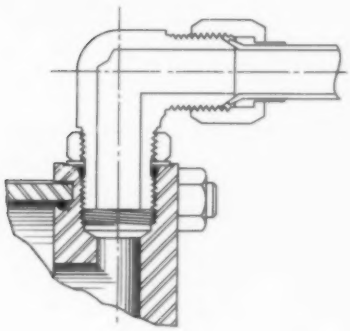
Bronze cartridge gland with "LIPSEAL"® and "WIPERSEAL" can be easily replaced without dismantling cylinder.

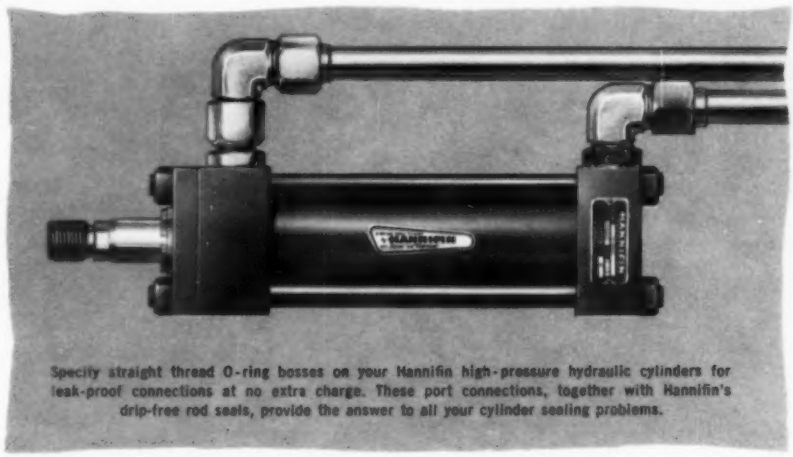
Drip-free rods, leak-proof ports...

get both with

HANNIFIN

hydraulic cylinders





Specify straight thread O-ring bosses on your Hannifin high-pressure hydraulic cylinders for leak-proof connections at no extra charge. These port connections, together with Hannifin's drip-free rod seals, provide the answer to all your cylinder sealing problems.

Select either "Slide-Seal" piston rings (standard) for most applications or exclusive "LIPSEALS" where zero "blow-by flow" is required.

For absolutely leak-proof connections under all operating and installation conditions, get Hannifin hydraulic cylinders with S.A.E. straight-thread ports. There's no extra cost. And because a straight-thread fitting is tightened *after* alignment, not aligned by "backing off," sealing is positive even when the cylinder must be mounted in tight quarters.

Straight-thread ports, plus the removable-replaceable cartridge gland that seals Hannifin cylinder rods drip-free, keep machines, floor and product free of hydraulic oil.

Other Hannifin cylinder features include ground and polished rods induction-hardened to an extra-deep case, then hard-chrome plated and polished again; cylinder walls that are "Tru-Bored" straight and perfectly round *before* being honed . . . PLUS 48-hour shipment in emergencies on standard Hannifin cylinders.

Your nearest Hannifin sales office or representative is listed in the A-Z volume of Thomas' Register. Call us in when cylinders figure in your designs. Or, for cylinder literature, write:

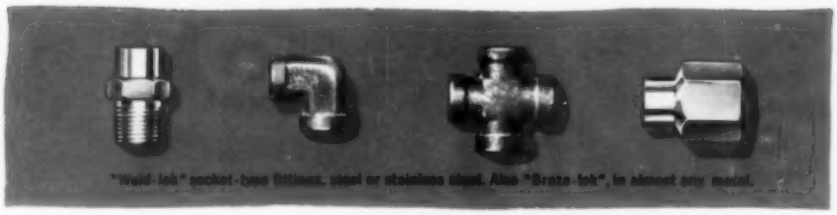
HANNIFIN COMPANY

515 South Wolf Road • Des Plaines, Illinois

PARKER-HANNIFIN FLUID-SYSTEM COMPONENTS

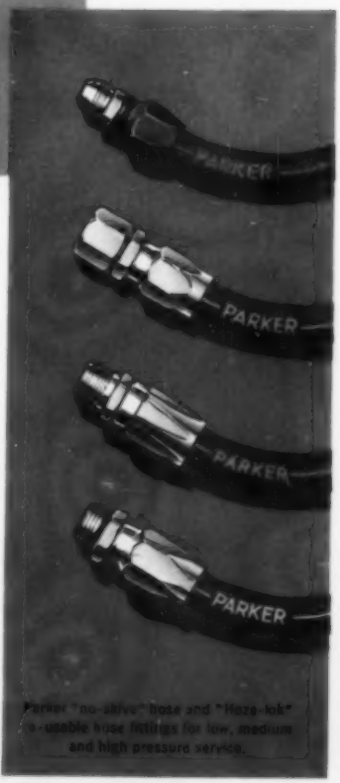
"Triple-lok", the "industrial standard"... in brass, stainless steel, aluminum, and cadmium plated steel. For flared tubing.

"Ferulok"®, the flareless type with the visible "bite", especially for heavy-wall tubing... in steel and stainless steel.



"Weld-lok" socket-type fittings, steel or stainless steel. Also "Braze-lok", in almost any metal.

"Intru-lok", especially for instrumentation lines. Flareless type in brass and aluminum.



Parker "no-skive" hose and "Hoze-lok" re-usable hose fittings for low, medium and high pressure service.

Only from Parker

such a wide range of fittings...so fast

If it's an industrial fitting, whether for tubing or for hose, Parker has it or can make it, in standard sizes in any metal.

Parker "Triple-lok" for flared tubing . . . Parker "Ferulok"® for heavy-wall tubing . . . Parker "Weld-lok" for high-temperature, high pressure lines. ("Braze-lok", our newest line, does not require an open torch, is for medium temperatures.) "Intru-lok", for copper, aluminum or plastic instrumentation lines, requires no flaring. Parker hose and "Hoze-lok" re-usable hose fittings require no skiving of the hose.

There's a Parker distributor near you, write us for his name . . . call him for Parker catalogs.

Parker Fittings and Hose Division
17325 Euclid Avenue • Cleveland 12, Ohio

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YOU SHOULD TRY ELECTRUNITE

The welded hydraulic fluid line tubing that costs less to buy... is easier to bend and flare!

The big switch is on! Hundreds of equipment and machinery builders and their maintenance departments are using millions of feet of Republic ELECTRUNITE Hydraulic Fluid Line Tubing. The reason... *cost reduction.*

ELECTRUNITE costs *less* to buy (in all sizes shown in the JIC Standards Book and in an even wider range of sizes produced to our specification HL-1). Savings in downtime reflect still greater economics. *In the history* of ELECTRUNITE Hydraulic Fluid Line Tubing, no failure resulting from longitudinal or transverse cracks has been reported.

Add to that the fact that ELECTRUNITE is easier to bend and flare. This tubing is made from *high-grade, close-tolerance, flat-rolled steel.* Checked for defects as only flat-rolled steel can be checked. Then: formed, welded, annealed, cold-worked, and annealed again into a tube of unsurpassed uniformity, a tube that meets or exceeds the normal life of tubing produced by any other method.

See for yourself. Contact your ELECTRUNITE sales representative or mail the coupon for complete information, including a copy of specifications.

MEETS ALL REQUIREMENTS OF THE JIC STANDARD!

ELECTRUNITE® is available in all sizes shown in JIC Standards Book. Available in a wider range of sizes produced to our specification HL-1 (which meets all test requirements of the JIC standard).

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Please send complete ELECTRUNITE Hydraulic Fluid Line Tubing information, including a copy of specifications.

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Company _____

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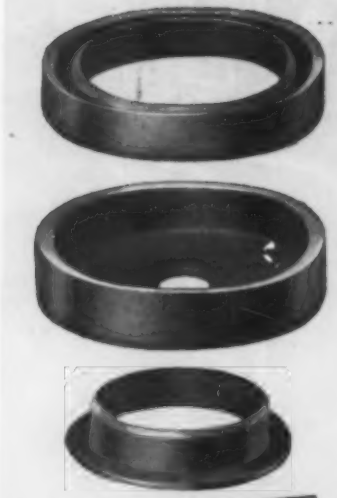


Cup Seals by LINEAR

in Viton A, Vyram, Polyurethane, and other unusual elastomeric materials having excellent resistance to many petroleum oils, synthetic lubricants, fuels, phosphate and silicate ester fluids—in a temperature range of —40° to +500°F.

LINEAR—specialists in close-tolerance molding in all of today's modern polymers . . . in both fabric reinforced and homogeneous materials.

These are low friction seals. For further help, call the LINEAR engineer.

PERFECTION IN RUBBER
LINEAR
LINEAR INC. STATE ROAD & LEVICK ST. PHILA. 35, PA.

Circle **92** on Time-Saver Card

BRIEFS

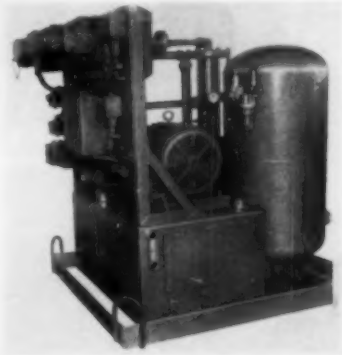
rest is raised to contact one of the bearings in the middle of the camshaft.

The steady rest is raised to a positive stop and locked in position while the gear teeth are being finished. When the operation is completed, the steady rest lowers and an air-cushioned mechanism lowers the camshaft into the exit chute of the loader.

Manufacturer is National Broach & Machine Co., Detroit. □□□

Power Unit With Integral Air-Oil Booster

The unit is designed for press welders where a constant pressure is needed to follow up the welding guns as the metal melts. An accumulator, precharged from a large air tank, keeps system pressure constant. Factory air pressure is admitted to a large tank through a regulating valve. This air pressure works against large area cylinders which buck small hydraulic cylinders. The ratio of the area of these cylinders determines the



pressure at the outlet of the accumulator. When the accumulator is full, an indicator rod actuates a limit switch to bypass the pump.

Made by J. N. Fauver Co., Inc., Detroit, the unit operates with petroleum base or fire-resistant fluids. □□□

Continued on page 38

BRIEF NOTES

NEW FILTER MEDIA . . . The AMFlex Products Dept., American Machine & Foundry, has developed a new filter media with precisely controlled pore sizes from 1 to 20 microns. The material is a fluorocarbon-coated, glassfabric-reinforced, glass paper. It has a greater flow rate than ceramic or porous filters of comparable pore size.

O-RING SIZE GAGES . . . The Parker Seal Co. has available two new gages which identify O-rings to the nearest Parker 2 size. A cone is used for sizes through 3-inch dia., and a tape for sizes from 3 to 8 inches.

MINIATURE SALES PORTFOLIO . . . Clippard Instrument Laboratory, Cincinnati, furnished all of its distributors and salesmen with a miniature sales portfolio. Less than half the size of a standard note book, it contains photographs of many applications of the company's line of miniature cylinders, valves, solenoids, and fittings.

ANOTHER HYDRAULIC FIRST . . . The Rucker Co., Oakland, Calif., supplied the recently launched N.M.S. Savannah, first nuclear powered merchant vessel to be built in the U. S., with a complete hydraulic system for actuating the control rods of the reactor control system. The unit is equipped with automatic monitoring devices which enable the control drives to shut down the reactor instantly. Special seals hold the hydraulic fluid in the system, so that water in the reactor system is not contaminated.

HYDRAULICS SPEEDS RIVER TRAFFIC . . . is the theme of a booklet published by The Oilgear Co., Milwaukee, Wis. The book includes illustrations and diagrams of the company's equipment used to operate the large gates on many of the country's river locks.

COMPRESSED AIR FUNDAMENTALS . . . is the title of a book available from Ingersoll-Rand Co., New York. It was produced to help select small packaged air compressors. It contains tables on cylinder diameters required to overcome various loads, volume of air per stroke, and flow of air through orifices.

interchangeable with all standard JIC cylinders

With the introduction of the ALL NEW T-J Squair Head, Tomkins-Johnson now offers industry the most complete design range of air and hydraulic cylinders. Presently available in bore diameters from 1½ to 8 inches, the T-J Squair Head is an interchangeable cylinder which produces maximum force and efficiency, with minimum pressures... and is also adaptable to the use of low pressure oil as the working medium. Write to The Tomkins-Johnson Co., Jackson, Michigan, for Bulletin #SQ 10-58 and complete details.

CHECK THESE 10 POINTS OF T-J SUPERIORITY

1 One Piece Piston

2 Hard Chrome Cylinder Bore and Piston Rods

3 High Tensile Steel Tie-Rods

4 Cushion Adjusting Screw, Externally Adjustable

5 New Super-Cushion for air, or Self-Aligning Master Seal for Oil (T-J Patents)

6 Solid Steel Heads and Mounting Plates Standard all Models

7 Port Design Allows Minimum Pressure Drop on Inlet or Outlet

8 Chevron Type, Self-Adjusting Rod Packing

9 Piloted Packing Gland—Absolute Alignment

10 Piston Rod, Extra Strong—Polished and Chrome Plated for Efficiency and Protection

T-J TOMKINS-JOHNSON

Now, at your service

jamesbury

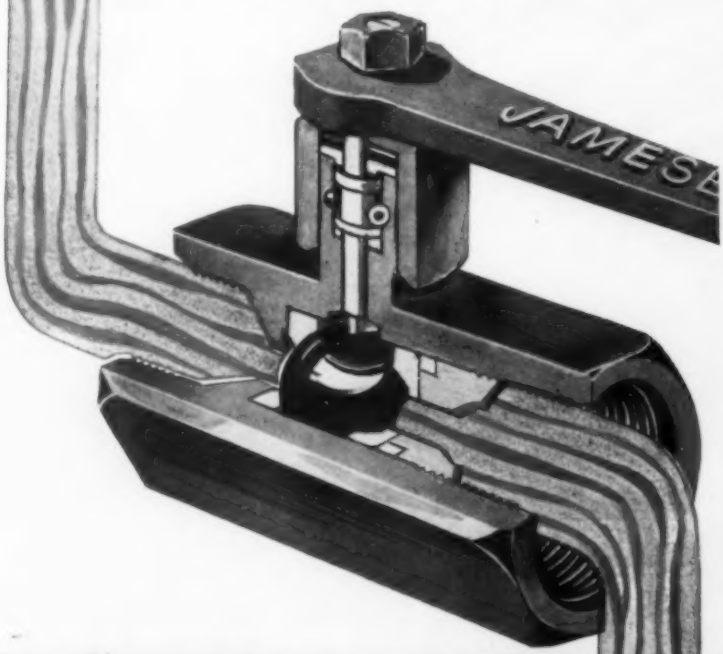
UNIT-BODY

"Double-Seal"™

HIGH-PRESSURE BALL VALVES

STYLE H SERIES

3,000-4,500 p.s.i. Range



. . . outstanding design newly available to industry

for
- High-Pressure service
- High-Vacuum service
- Handling of hazardous fluids
- Cryogenic operations

. . . no other valve has these outstanding features

- Unit-body construction
- Positively leakproof
- Full-flow capacity
- Indestructible in service
- Corrosion-resistant
- Contamination-proof
- Incomparable size-rating-test-burst performance ratio

—a newly developed and advanced valve design with broad industrial applications, available in eight sizes through 2", with 303 and 316 Stainless Steel or Carbon Steel bodies. Choice of nylon or "Teflon" seats and seals.

Distributors in principal cities.

For further information, write: Data: Style "H" Series

JAMESBURY CORP., 85 NEW STREET, WORCESTER, MASS. 285-6

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BRIEFS

Marine Hydraulics Conference

Immediately preceding the 1959 meeting of the Society of Naval Architects and Marine Engineers, Vickers Incorporated is sponsoring a conference on the use of oil hydraulic systems aboard ship. The 2-day meeting will be held November 10 & 11 at the Savoy-Hilton Hotel in New York City.

The meeting will be of the audience participation type designed to encourage industry leaders to exchange opinions freely on how hydraulics can speed up cargo handling and increase efficiency of other vessel operations.

Moderators are Captain J. M. Reigart USN, Head of Code 632, Bureau of Ships, and Mr. Parke Adair of the J. J. Henry Co., New York.

AH&P editors will attend and a full report of the conference will be published in the February 1960 issue, which has for its theme Marine Hydraulics. □ □ □

FIVE-STATION ROTARY INDEX MACHINE is hydraulically operated and electrically controlled. Its 60-inch diameter table is hydraulically indexed to stations for drilling, milling, spotfacing and tapping. Hydraulic cylinders clamp the parts during machining. Made by Snyder Company, Detroit, Mich, with standard modular components and a separate hydraulic power unit.

Two Hydraulic Cylinders Advance Quill in Drill Machine

High-speed, single-spindle, horizontal drilling machines use two hydraulic cylinders to do many operations.

High feed rates are achieved by the design of the precision

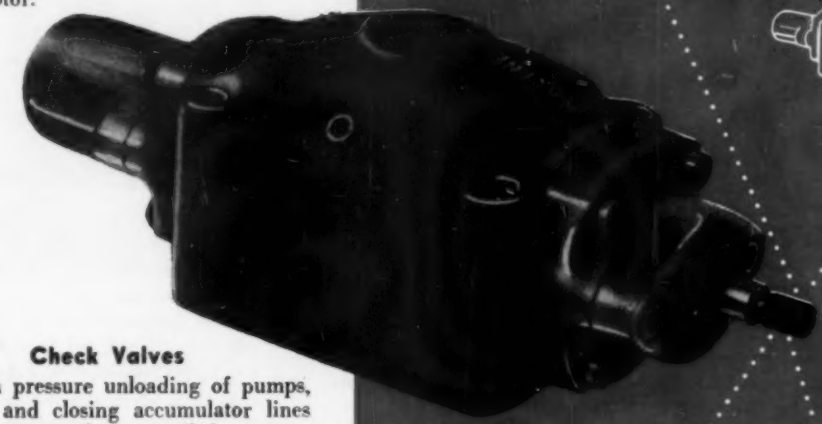
Continued on page 40

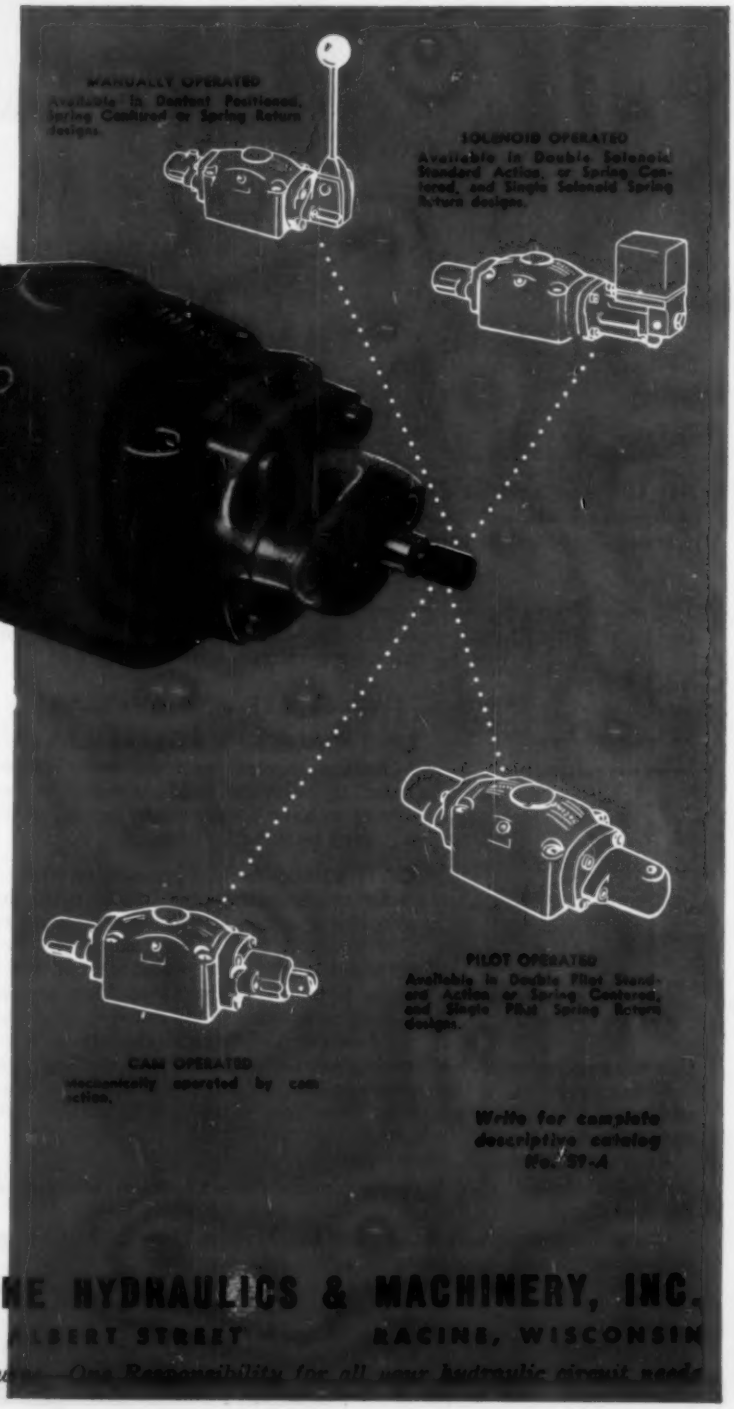
RACINE-SECO

Hydraulic Valves

DIRECTIONAL CONTROL VALVES
Valves 4-way and 2-way

Designed to conform with J.I.C. specifications. All sizes ⅜" to 2" — foot or sub-plate mounted, with neutral porting arrangements to suit your needs. Pressure rated up to 1500 psi. Sleeve type construction permits controlled acceleration or deceleration of a cylinder or fluid motor.




MANUALLY OPERATED
Available in Detent Positioned, Spring Centered or Spring Return designs.
SOLENOID OPERATED
Available in Double Solenoid Standard Action, or Spring Centered, and Single Solenoid Spring Return designs.
PILOT OPERATED
Available in Double Pilot Standard Action or Spring Centered, and Single Pilot Spring Return designs.
CAM OPERATED
Write for complete descriptive catalog No. 59-A

Check Valves

For high pressure unloading of pumps, opening and closing accumulator lines and when properly grouped for use as high pressure directional valves for 3-way or 4-way functions. Sizes ⅜" to 2" up to 10,000 psi. Design conforms with J.I.C. specifications.

VOLUME CONTROL VALVES

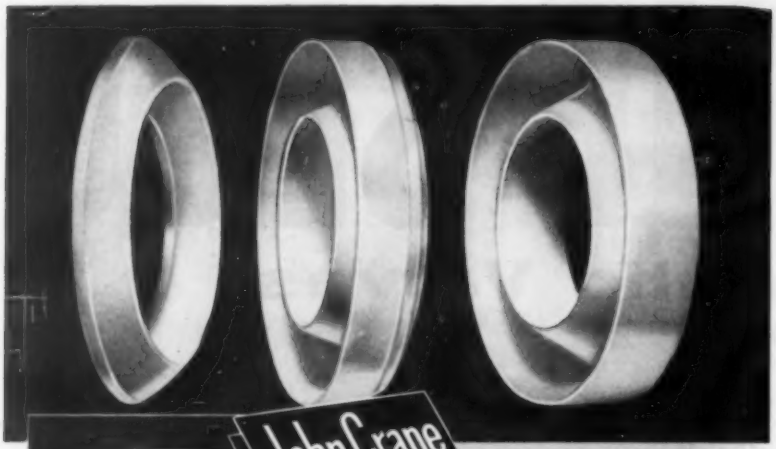
Pressure compensating and non-compensating types available. ¼" to 2" sizes. Pressure compensating valves are ideal for Meter In, Meter Out or Bleed-Off control of accurate oil flow.
Non-compensating valves provide an adjustable flow rate by varying the adjustable orifice. Designed to J.I.C. standards.

PRESSURE CONTROL VALVES

A complete line including Relief, Sequence, Counterbalance, Resistance and Counterbalance and Pressure Reducing Hydraulic Valves. Sizes ⅜" to 1¼". 100 to 1500 psi pressure range.

RACINE SECO

RACINE HYDRAULICS & MACHINERY, INC.
2074 ALBERT STREET — RACINE, WISCONSIN
One Source—One Responsibility for all your hydraulic circuit needs



John Crane

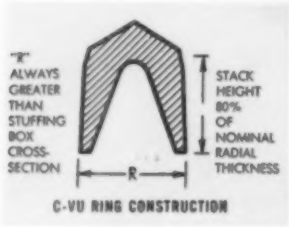
CHEMLON *

C-V RINGS

ARE INDUSTRY'S MOST UNIVERSAL PACKING . . .

Countless successful applications of C-V Rings under the most severe service conditions have made this the closest approach to a universal packing.

It will effectively handle all industrial acids, alkalis, solvents, organic and hydraulic fluids . . . temperatures from −120°F. to +500°F. . . . is equally suited to valves, pumps, mixers, hydraulic cylinders and like equipment.

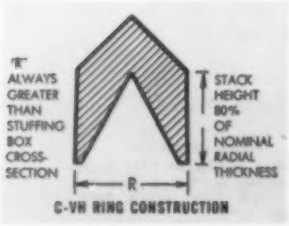


C-VU RING CONSTRUCTION

"John Crane" C-V Rings have extremely low coefficient of friction. "Breakout" friction is only slightly higher than running friction.

TWO STYLES ARE AVAILABLE:

C-VU RINGS *for low pressure service* —such as control and regulator valves handling gases and fluids, where it is necessary to have a very sensitive and resilient type packing.



C-VH RING CONSTRUCTION

C-VH RINGS *for high pressure service* —for use in pumps, hydraulic cylinders and like services at pressures ranging to 500 psi. and over. These rings are constructed with a heavy wall heel to withstand pressure requirements. They are designed to provide voids between rings, so that as the Teflon expands due to heat, this take-up room minimizes any excess friction in the stuffing box.

"John Crane" C-V Rings are available in full line of standard sizes and male and female adaptors. Sizes can be molded to stuffing box specifications.

Request Bulletin P-325.

*"John Crane" C-V Rings are made from Chemlon—*the best in DuPont Teflon.*

Crane Packing Co., 6405 Oakton St., Morton Grove, Ill. (Chicago Suburb). *In Canada: Crane Packing Co., Ltd., Hamilton, Ont.*

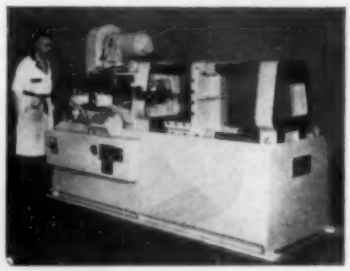
CRANE PACKING COMPANY

Circle **40** on Time-Saver Card

BRIEFS

motorized drill spindle. Driven by a 10-hp motor through V-belts and a multiple speed drive, the spindle is a 4" dia. hollow quill travelling in a honed sleeve. Two 3¼"-dia. hydraulic cylinders advance the quill. They can develop up to 16,000 lbs. thrust to feed the drill into the work.

Built by Walter P. Hill, Inc., Detroit, the machine is versatile for many work setups. The size



of the machine, number and size of drill spindles, hydraulic system, coolant system and motor sizes can be varied.

The hydraulic power unit is a 10 gpm, 1000 psi variable flow hydraulic pump, 7½ hp motor, and tank is in the machine base. A 1000 psi coolant pump, driven by a 5 hp motor, also is in the machine base.

This pump feeds coolant through the quill for use with oil hole or gun-drill type tooling. Nozzle flow from a pipe directs coolant to standard twist drills.

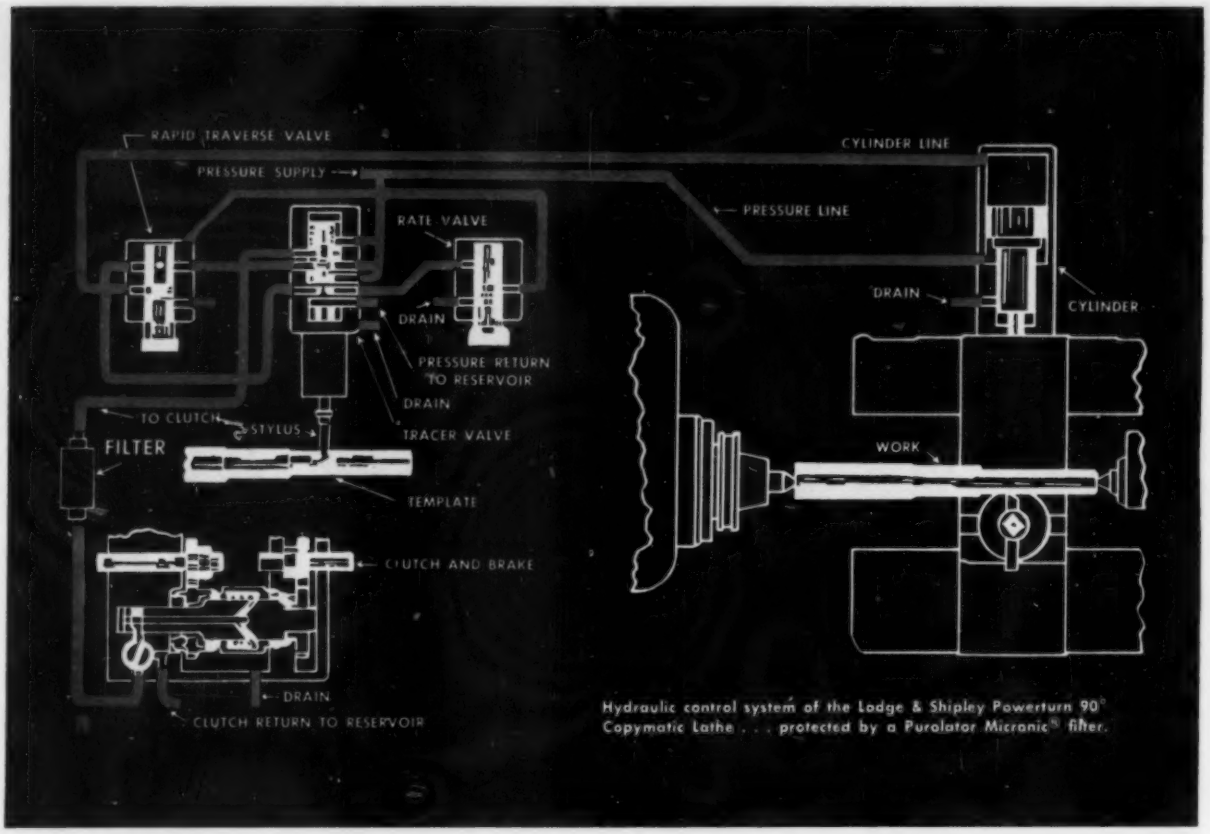
Feeds are adjustable from 0-150 ipm; spindle speeds are from 600-4000 rpm. Total head travel is 12 inches. □□□

Quick Disconnects Ease Wind Tunnel Operation

Steel plates held in place with hydraulic cylinders form diffusers for air in Convair's supersonic wind tunnel. Air velocities of 3700 mph place tremendous loads on the diffusers.

Between test runs, researchers must enter the tunnel to adjust the test model. To allow access to the tunnel, the downstream diffuser

Continued on page 44



Hydraulic control system of the Lodge & Shipley Powerturn 90° Copymatic Lathe . . . protected by a Purolator Micronic® filter.

Designed for highly accurate control ...fully protected by Purolator Filtration

On a very successful automatic duplicating lathe, this hydraulic control system makes possible both quick, simple operation and a high degree of sensitivity and accuracy. Reliable and uninterrupted operation of a system like this is dependent upon freedom from contaminants. That's why the Lodge and Shipley Company, its manufacturer, made Purolator Micronic® filters an integral part of their hydraulic system.

Purolator engineers recommended a standard filter from their stock of over 2000 models. It more than met the system's special requirements.

The controlled porosity of Purolator's Micronic element evenly filters out contaminant particles as small as .000039 inch. And because it's made of plastic-impregnated cellulose, the Micronic element is not affected by high temperatures, water, or oil.

PUROLATOR

PRODUCTS, INC.

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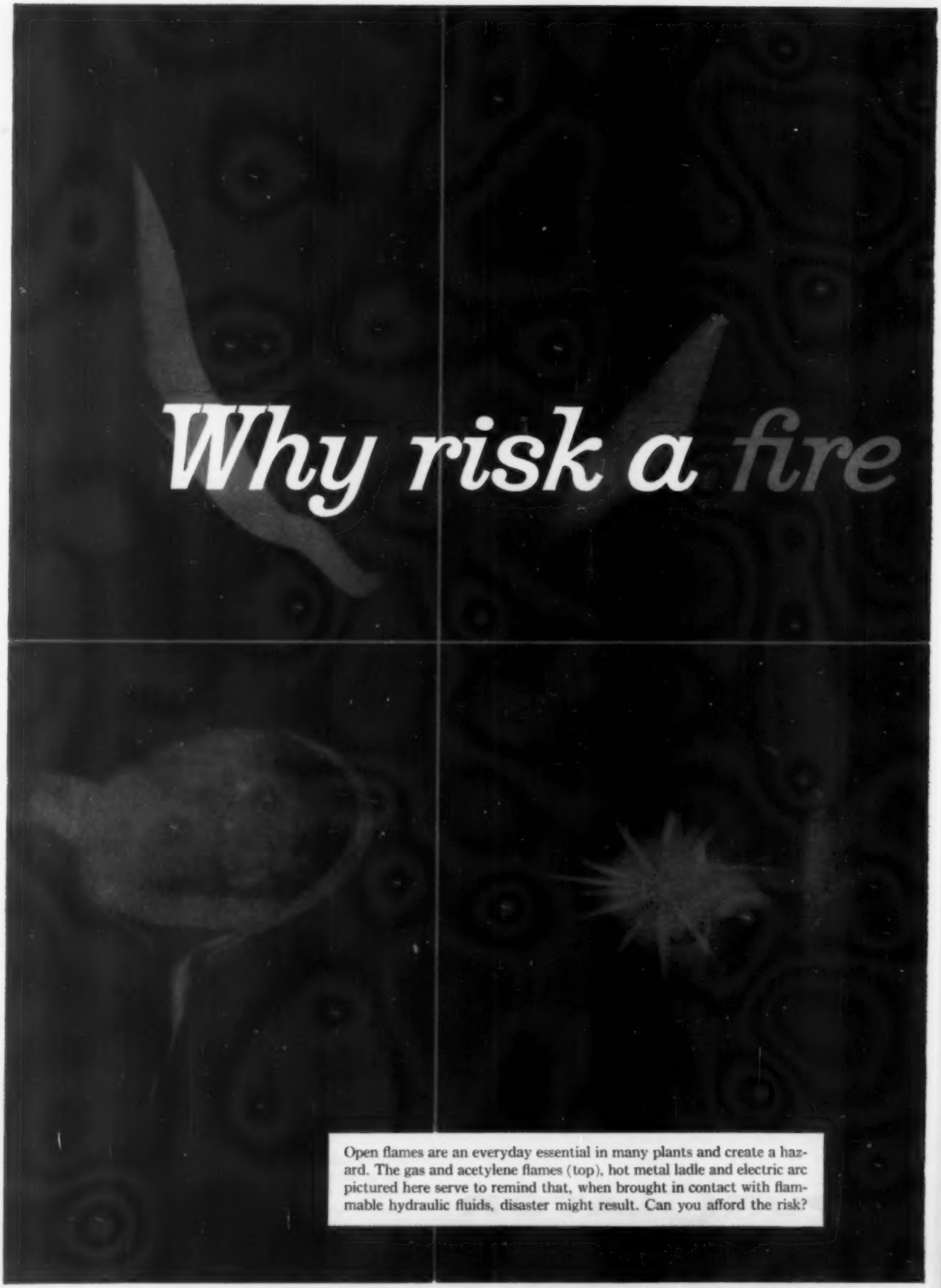
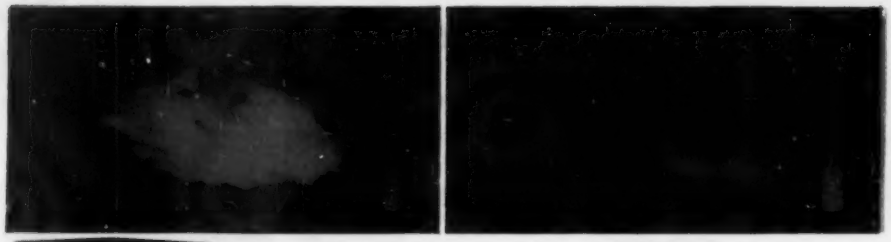


Open flames are an everyday essential in many plants and create a hazard. The gas and acetylene flames (top), hot metal ladle and electric arc pictured here serve to remind that, when brought in contact with flammable hydraulic fluids, disaster might result. Can you afford the risk?



Mobil Research

At left: Test developed by Mobil Research shows how atomized petroleum hydraulic fluid is easily ignited by small gas flame; at right, how when replaced by Mobil Nyvac, no ignition occurs.

disaster? *Insure the safety of your plant and personnel with a Mobil fire-resistant hydraulic fluid!*

Mobil's newly developed family of fire-resistant fluids for hydraulic systems meets every type of industrial requirement . . . provides adequate protection at lowest possible cost.

When you change to Mobil fire-resistant fluids, you get the assistance of trained Mobil engineers who analyze your plant systems, tell you which fluid should be used. Mobil engineers also help you install the fluid properly and set up an effective maintenance program; provide practical field-tested procedures for reducing leakage and increasing efficiency.

These Mobil fluids offer a practical means of safeguarding personnel, property, production schedules . . . increasing your sales profits. Call in your nearest Mobil representative today. He'll be glad to give you full details.

Mobil Pyrogard—a superior synthetic product of the phosphate-ester type family. Very successful in hydraulic systems and multi-stage compressors. Outstanding anti-wear quality; excellent anti-rust and anti-foam properties.

Mobil Nyvac—combines the fire-quenching qualities of water with glycol and special additives for lubricity and viscosity. Rust inhibitors protect machine parts both above and below fluid levels. Unusual resistance to deposit formation and wear. Impressive viscosity stability, anti-corrosion, and anti-foam properties. Excellent performance at low temperatures.

Mobil Solvac—low-cost, oil-water emulsion fluid particularly suited to systems with plunger and centrifugal-type pumps. For systems serving large presses, forging machines, rubber presses and steel mill back-up roll balances. Resists bacterial growth, has excellent rust-inhibiting properties.

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BETTER MACHINE CONTROL...
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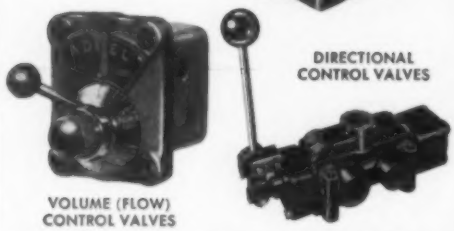
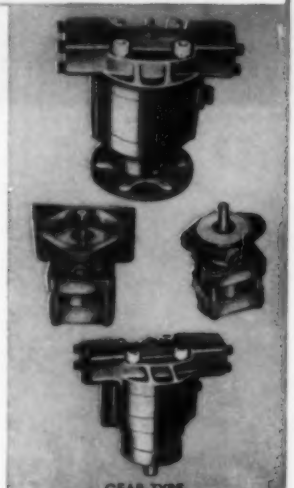
PILOT OR SOLENOID OPERATED VALVES



DIRECTIONAL CONTROL VALVES

VOLUME (FLOW) CONTROL VALVES



GEAR-TYPE HYDRAULIC PUMPS

New Industrial Gear Type Hydraulic Pumps with capacities from ¼ to 35 GPM at pressures to 1500 PSI and speeds to 3600 RPM.

The diagrams show but two of innumerable circuits and systems where these versatile pumps and control valves can be used to advantage.

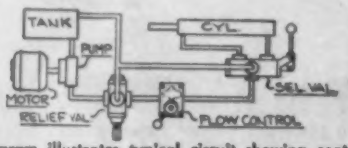


Diagram illustrates typical circuit showing control of cylinder.

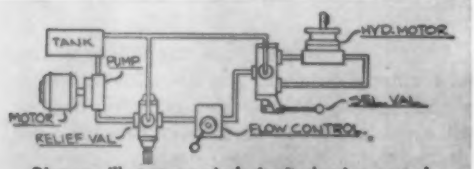


Diagram illustrates typical circuit showing control of hydraulic motor.

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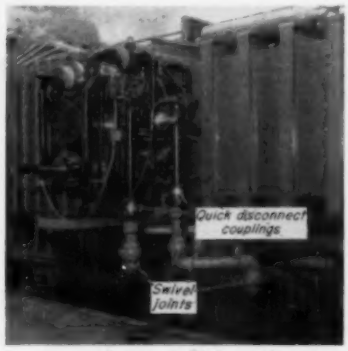
BRIEFS

section is mounted on tracks leading to the tunnel outlet.

The 4-inch hydraulic lines feeding the cylinders in the diffuser must be disconnected each time the unit is moved. Standard



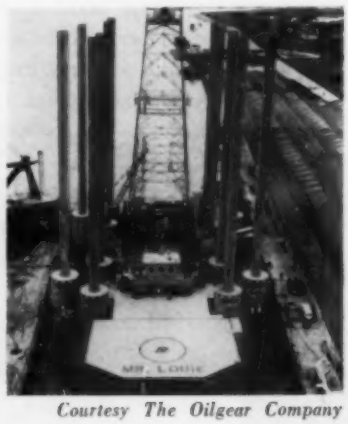
Courtesy Chiksan Company

pipe connections would take too long to disconnect.

The operation was speeded up by using standard swivel joints, and quick-disconnect, wing unions. The quick disconnects can be opened by a tap of a hammer and two revolutions of the connecting nut. □□□

"Mr. Louie" Has 12 Servo-Controlled Legs

This 4000-ton, offshore oil-drilling barge, called "Mr. Louie," is supported by 12 caissons. The



Courtesy The Oilgear Company

platform can be raised 40 feet out of the water where the depth is 120 feet.

An electro-hydraulic servo system directs and positions the plat-

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DOLLINGER SUMP FILTER

FOR COOLANTS, HYDRAULIC OILS AND LUBRICANTS

New low price—made possible by a new, simplified filter design.

All new design—As a result of a nationwide study to determine the actual service conditions for sump filters, this new Dollinger Sump Filter was designed. Already, leading hydraulic equipment manufacturers have standardized on this filter for their products. The new design incorporates molded end seals made from a specially formulated plastic impervious to all synthetic oils at temperatures to 300°.

Molded End Seals Reduce Cost
. . . eliminate costly machining. Special plastic impervious to all synthetic oils, mild acids, coolants, and water to 300° F.

One Piece Construction
No spare parts necessary. Positive protection against dirt, sludge, rust and abrasive particles causing pump failure.

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Permits larger filter capacity in smaller area. Mesh screen supplied in 60 or 100 screen depending on efficiency desired and fluid viscosity.

***Eight standard sizes* available. Capacities from 5 to 100 gpm.**
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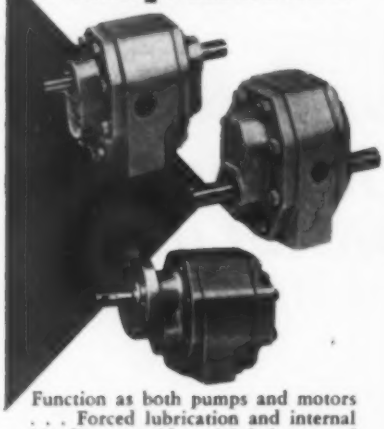
PRECISION-ENGINEERED PRECISION-MACHINED INDUSTRIAL HYDRAULIC EQUIPMENT

Pump-Motors



Function as both pumps and motors . . . Forced lubrication and internal bleeding provide axial balance and eliminate high pressures against oil seals . . . Rotation in either direction . . . Heavy-duty roller bearings . . . Small cube space . . . 8, 17, 25 GPM at 1000 PSI . . . Gear type, constant displacement.

Control Valves

Large oil passages . . . Close grained, high tensile alloy body castings . . . 2 types of action . . . Spring centered, ball detent hold . . . Hardened ground spool . . . Precision honed valve body . . . Pressure relief valve . . . Hardened seat insert for long life.

Engineering ingenuity in designing and manufacturing hydraulic systems and assemblies to your own exacting specifications.

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Waukesha 4, Wisconsin

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BRIEFS

form on the caissons. The signal from a single potentiometer is amplified and sent to each of the 12 servo-controlled pumps at the caissons.

Integral with each caisson are large external rings spaced on 18-inch centers. The platform is moved by extending and retracting a set of moveable jaws that fit over the rings. After each stroke of the cylinder that moves the jaws, a second set of fixed jaws engage the caisson rings. The moveable jaws then open and the cylinder returns them to position for another stroke. □□□

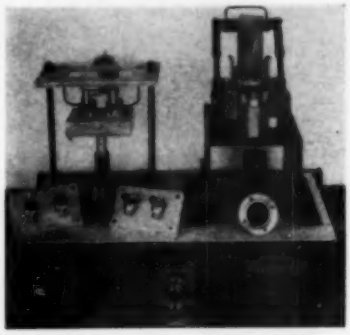
New Books

Tool Engineers Handbook, Second Edition. Revised under supervision of American Society of Tool Engineers. Edited by Frank W. Wilson & Philip D. Harvey. Published by McGraw Hill Book Co., New York, 2289 pages, $19.50.

The handbook includes the latest in tool design, fabrication, and maintenance. Spark machining, electrolytic grinding, surface cleaning by supersonics, and other recent advances are covered. □□□

Fast Brazing For Valve Bodies

Brass and steel valve bodies are brazed quickly and safely with this production line brazing setup. They are brazed at a rate of two in 40 seconds for brass, and one in 30 seconds for steel. There is



no overheating or damage to the finished threads in the valve body. Three sizes of valve assemblies can be brazed with the same coil.

Made by Induction Heating Corporation, Brooklyn, N.Y., the system can be adapted for brazing fittings or other small components. □□□

BUSINESS BRIEFS

SALES UP 33% . . . For the fiscal year ending June 30, 1959, Moog Servocontrols, Inc. reported total sales of $10,366,744 which was a 33% increase over the $7,800,735 in the previous fiscal year. This year's net earnings were $513,355, as compared to $114,969 for last year.

RECORD SALES . . . were reported for the fiscal year ending June 30, 1959 by The Garrett Corporation, Los Angeles. Total sales were $193,641,345 and earnings after taxes were $4,767,796 or $4.61 per share. These figures, compared with sales of $170,409,368 for the previous year and earnings of $4,118,707 or $3.98 per share.

PRICE CUT . . . of $5.00 per pound on Du Pont's Viton synthetic rubber was announced by the company. Ability of the elastomer to perform at 600 F has increased its sales sufficiently to permit the price cut. The new price is $10.00 per pound.

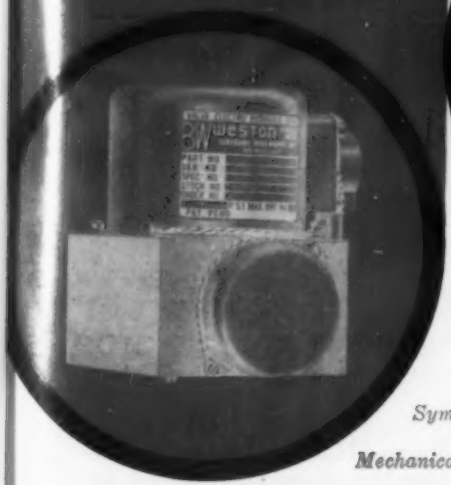
CORPORATION SPLIT . . . George A. Starbird, president of Meletron Corp., announced the separation of his organization into two individual corporations owned by the same stockholders. The Meletron Corp. becomes solely a sales and engineering firm by transferring all production to the Pressure Switch Corp., a wholly owned subsidiary.

PURCHASES ELECTRONIC FIRM . . . The Bellows Co., a Division of The International Basic Economy Corp. has purchased the Jackson Electronic and Manufacturing Co. of Akron, Ohio. The purchase of the electronics firm will permit Bellows to broaden its activity in the field of interlocked electronic, pneumatic, and hydraulic circuits

Circle **156** ➡

get all these features with the new

WESTON ELECTRO-HYDRAULIC SERVO VALVE!



HIGH RELIABILITY

Symmetrical mechanical and hydraulic design

***Mechanical** feedback from second stage valve position*

Dry coil torque motor

***Large** single filter for hydraulic amplifier*

***Dynamically** balanced for resistance against vibration*

Superior low temperature operation

The new lightweight Weston Electro-Hydraulic Servo Valve, developed after an extensive program of research and testing, combines all these outstanding features. The results are smooth, stable operation under a wide range of flow and temperature conditions, with more positive positioning accuracy and higher reliability even when used with contaminated fluids. Greater null stability is assured. For more information about the new Weston Electro-Hydraulic Servo Valve, write for Technical Report No. 101. Contact Weston Hydraulics, Limited, or any of the following offices.

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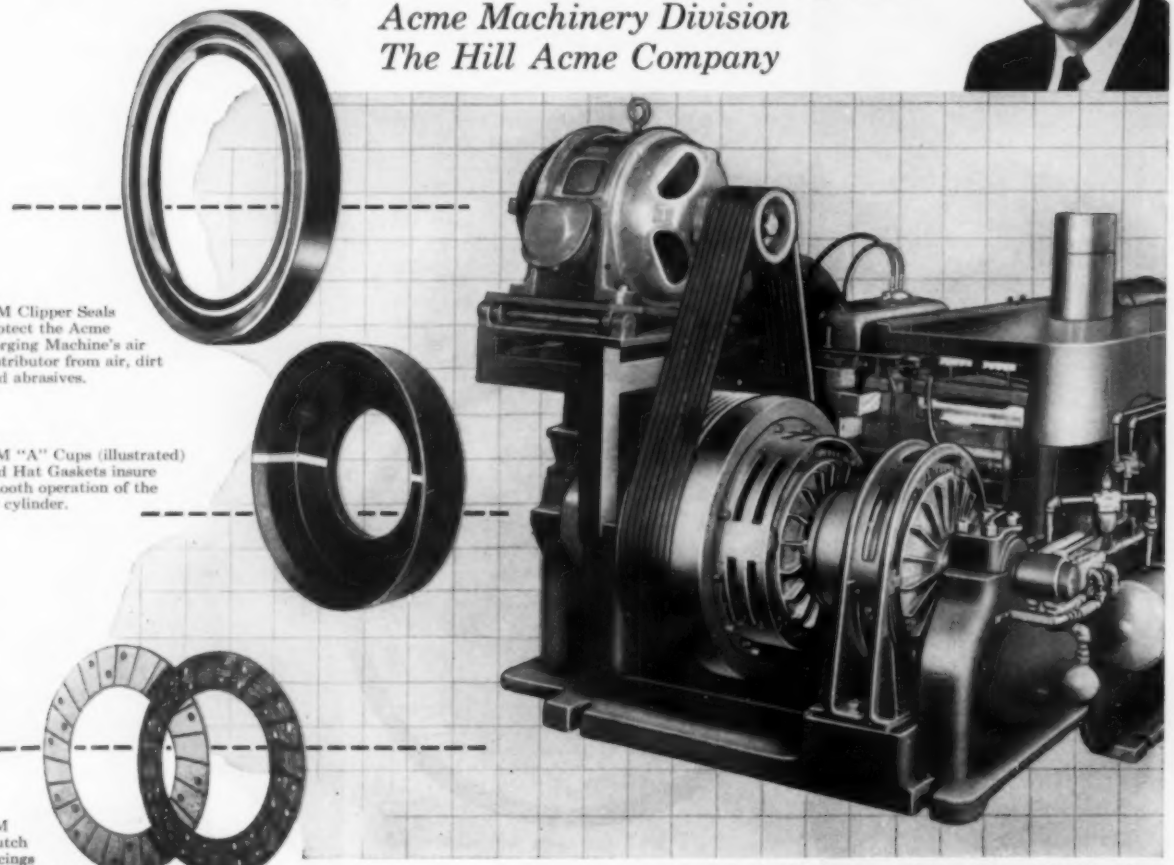
"Customer satisfaction hit a new high when we redesigned Acme forging machines with J-M Packings and Friction Materials,"

says M. W. Lamprecht, Chief Engineer
Acme Machinery Division
The Hill Acme Company



J-M Clipper Seals protect the Acme Forging Machine's air distributor from air, dirt and abrasives.

J-M "A" Cups (illustrated) and Hat Gaskets insure smooth operation of the air cylinder.

J-M Clutch Facings (illustrated) and Brake Linings play integral parts in the Acme Forging Machine's cushion drive mechanism.

Acme Forging Machines are widely used by metalworking plants all over the world. They are made by Hill Acme Co., pioneers and leaders in construction and design of modern forging machines.

J-M products defy extreme thermal and mechanical shock for dependable performance and long life

In terms of thermal and mechanical shock and the constant presence of dirt, chips and other abrasives, Acme Forging Machines provide one of the most rugged tests ever devised for packings and friction materials. In more than 20 years of service, Johns-Manville products have achieved an enviable record with Acme users. Performance has been more than satisfactory in every way and replacement has been held to the minimum.

Johns-Manville makes a complete line of packings, gaskets, asbestos textiles, brake linings, clutch facings, transmission bands and industrial friction materials. Chances are one or more of these products may provide the answer to your design problems. For further information call your local J-M sales office or write Johns-Manville, Box 14, New York 16, N. Y. In Canada, Port Credit, Ontario.

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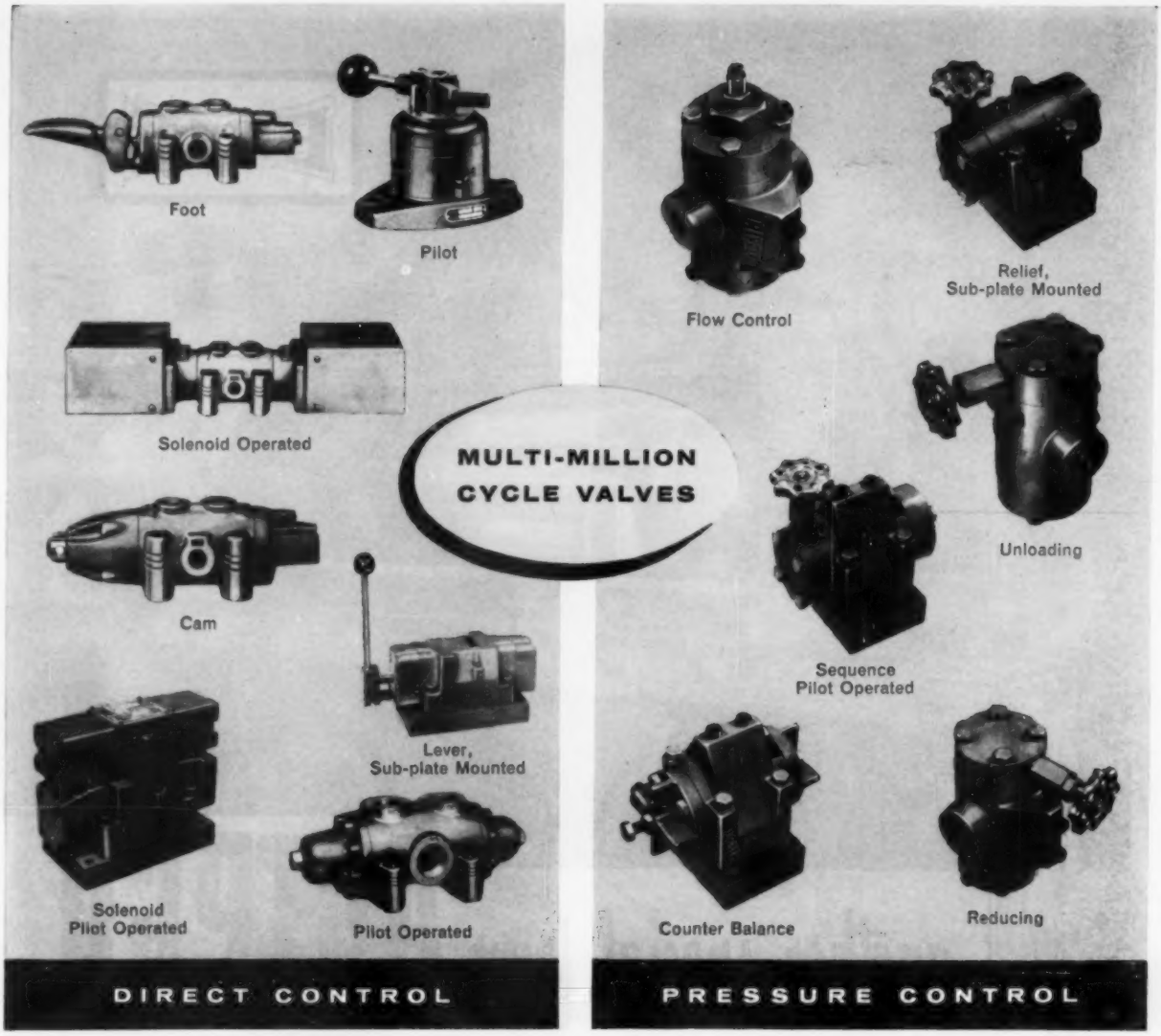

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Whatever your requirements, you can find the right valve at Rivett. Save time, money, inventory and maintenance with these most advanced designs. Greater flow capacity; minimum pressure drop; positive damping and operating stability. From single basic assembly of functional valve any one of six functions may be obtained. Over 400 standard models—sub-plate and pipe mounted; direct control and functional. Pressures 1500 and 3000 P.S.I. All actions, all piston designs, all operations. Sizes ¼" to 2". J.I.C. standards.

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Cat.'s 204, 210, 230 and 261 contain 68 pages describing all valve models, sizes and types with complete working drawings, specifications, performance, ratings, cut-away views. Get free copies today.

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HYDRAULIC VALVES

another special from ACIPCO

ERIE FOUNDRY CO. PICKS ACIPCO TUBING FOR CARBON EXTRUSION PRESS PLUNGER

You're looking at a new 2000-ton horizontal carbon extrusion press manufactured by the Erie Foundry Company's hydraulic press division. Designed for the production of carbon electrodes, the press features ACIPCO centrifugally spun steel tubing in its main ram plunger.

Custom-spun by ACIPCO, the plunger is 30.50" O.D. with 125 micro-inch finish and 2-5/8" wall thickness. Main ram is 42" in diameter and has a 105" stroke. Produced with heads statically cast at ACIPCO, the plunger's overall length is 144".

Fabricated applications such as this are a specialty with ACIPCO. Completely equipped to solve a wide variety of tubing problems, ACIPCO can serve your needs more efficiently and economically because all its facilities are under one roof. For expert consultation on centrifugally spun tube applications in your field . . . call on ACIPCO.

VERSATILE ACIPCO CENTRIFUGALLY SPUN STEEL TUBES

SIZE RANGE: Lengths up to 410" to meet modern machinery requirements have been produced. OD's from 2.25" to 58"; wall thicknesses from .25 to 4".

ANALYSES: All alloy grades in steel and cast iron, including heat and corrosion resistant stainless steel, plain carbon steel and special non-standard analyses.

FURNISHED: As cast, rough machined, or finished machined, including honing. Complete welding and machine shop facilities for fabrication.

SPECIAL PRODUCTS DIVISION

AMERICAN CAST IRON PIPE CO.

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an *effective one-piece* double-acting seal!

Specially designed for double-acting cylinders—the new "Hallprene" Patent Double-Acting Fluid Seal.

- ✳ Improves sealing
- ✳ Prevents the possible formation of fluid traps
- ✳ Reduces costs
- ✳ Simplifies piston design
- ✳ One seal replaces two

The new "Hallprene" double-acting seal has been developed from the highly successful "Hallprene" Patent Fluid Seal—the most efficient seal for single-acting applications.

Hallprene PATENT DOUBLE-ACTING FLUID SEAL

(PATENTS APPLIED FOR)

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Components, tools and equipment for fluid power systems. For more information fill in and mail post card bound in this issue.

SERVOVALVES
. . . in four sizes

Designation: 71 Series

Features: Integral, field-replaceable filter eliminates contamination problems. Applications include machine tools, earth moving machines, ma-

terial handling equipment, nuclear reactors, and edge controllers.

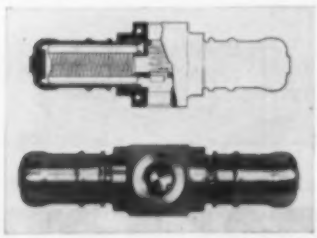
Specifications: Four sizes at 1000-psi valve drop, 15-ma. differential current: 1.0, 2.5, 5, and 10 gpm. Operate at system pressures from 500 to 4500 psi. Weight: 7.25 lbs, temperature range, 0-250 F.

Moog Servocontrols, Inc.
East Aurora, N.Y.
Circle **300** *on Time-Saver Card*

FILTER ASSEMBLIES
. . . are dual-bowl type

Designation: Series 5868

Features: For high pressure, high flow capacity fluid systems. House



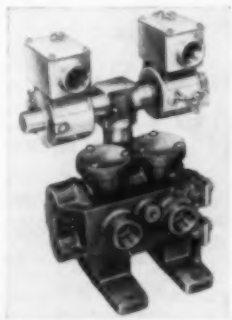
two, standard AN 6235-4 filter elements. Flow rate capacity doubled. Filter head has valve to by-pass fluid if element becomes clogged.

Specifications: Six media filter from 2 to 250 microns. Temperature ranges from —350 F to 350 F. Flow range, with 10-psi pressure drop, from 2 to 24 gpm with Mil-H-5606; 200 to 2300 scfm with air at 3000 psi. For system operating pressures to 5000 psi. Rated burst pressure 12,000 psi.

Bendix Filter Division
Bendix Aviation Corp.
Madison Heights, Mich.
Circle **301** *on Time-Saver Card*

MOMENTARY CONTACT AIR VALVES
. . . in single, dual models

Features: Single solenoid, 2-position, 4-way valve operation: electric impulse actuates solenoid, plunger moves down, actuates pilot valve which operates main valve. Plunger then latches pilot valve in this position, even after power is



cut off. Next electric impulse makes plunger unlatch contact device. Pilot and main valve members revert to normal position. Dual solenoid units, used in automation, keep valve in phase. Solenoid #1 is actuated, pilot latched as above, but additional impulses to solenoid #1 will not unlatch pilot. Valve reverts to normal only when solenoid #2 is actuated.

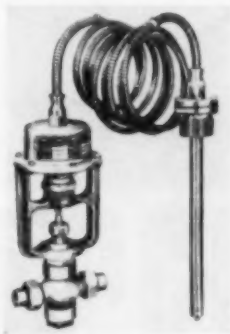
Barksdale Valves
Los Angeles, Calif.
Circle **302** *on Time-Saver Card*

TEMPERATURE REGULATORS
. . . for heating, cooling fluids

Designation: Type TC, TCX Series

Features: Vapor-pressure operated. Available as direct acting regulators for heating applications, or as reverse acting regulators for cooling.

Specifications: TC Series: bronze bodies in sizes from ¼″ to 2″, with



union connections. Iron or bronze bodies from 2½″ to 5″, with 125-lb. ASA flanged ends. Temperature ranges in 40 F increments from 25 F to 385 F. TCX Series: bronze bodies from ¼″ to 2″. Temperature ranges in 70 F increments from 50 F to 310 F. For both types: capillary tubing, cable, temperature bulbs and wells in various metals.

A. W. Cash Valve Mfg. Corp.
Decatur, Ill.
Circle **303** *on Time-Saver Card*

WELDED TUBING
. . . makes one-piece system

Features: Tubing is designed for piping fluids where internal corrosion is not a factor. Method of connecting improves on screwed and welded piping joints. One end of each tube length is expanded. Plain ends fit into expanded sections, where they are brazed or soldered. Heat and

Continued on page 54

SERIES 101A

AIR 150 PSI • HYDRAULIC UP TO 1500 PSI • MEETS JIC STANDARDS

By fitting into one-third less space than a tie-rod cylinder of the same bore, this original O-M space-saving component gives greater flexibility to design, reduces weight and cuts installation time.

But there are many other reasons for using this O-M Round-line Cylinder that delivers smooth, dependable power. It has the lowest coefficient of friction . . . assures full-power starts . . . is sealed right—ports are easily oriented independently to 360 degrees...and, end plugs are tapped for universal mounting. Easily modified for special applications at a nominal extra over standard cylinder prices. Internal locking key makes it easy to disassemble, service and reassemble with no alignment problems.

Available for Air or Hydraulic circuits in a complete range of sizes (1½" to 8" bores) with standard, 2 to 1 or oversize rods. All-steel construction with bearing bronze. Completely interchangeable parts. Immediate delivery on many sizes.

Mail coupon at once for Bulletin 101A containing engineering drawings of cylinder, mounts, mounting brackets, capacity chart and other data.

ORTMAN-MILLER MACHINE CO
1143rd Street, Hammond, Indiana

☐ **Have representative call**
☐ **Send Bulletin 101A**

NAME_____ POSITION_____

COMPANY_____

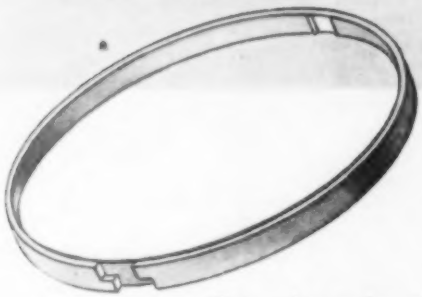
ADDRESS_____

CITY_____ ZONE_____ STATE_____

Circle **107** *on Time-Saver Card*

SOMEWHERE BETWEEN THE POWDER AND THE PART...

...lies the difference in the quality of intricate Teflon* pieces



Processing makes this difference. The way a piece is molded, sintered, or cooled dictates the way it will perform on the job.

One way to be sure that a Teflon part has been processed properly is to let Garlock's Plastics Division, United States Gasket Company, do the job. U.S.G.'s years of experience with fluorocarbon resins guarantees you the right properties every time, regardless of how intricate the shape, how thin the wall section, or how close the tolerances.

Make U.S.G. your prime source of molded Teflon parts. Let your local Garlock representative quote on your design, or ask his assistance on any design problems you may have. Call him, or write

THE GARLOCK PACKING COMPANY
Palmyra, N.Y.

For Prompt Service, contact one of our 26 sales offices and warehouses throughout the U.S. and Canada.

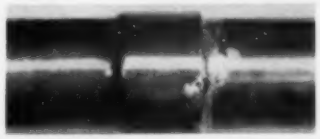
**DuPont Trademark for TFE Fluorocarbon Resin*

United States Gasket *Plastics Division of* **GARLOCK**

Circle **144** *on Time-Saver Card*

NEW PRODUCTS

solder are applied to only one point of joint, permitting connections in confined areas. Ends are held to close tolerance. Inside finish is smooth, free from scale.

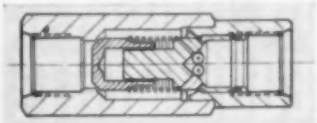


Specifications: Tubing is smaller, lighter than comparable pipe sizes. Resistance welded from flat rolled steel. Hydrostatically tested to 2000 psi or 20,000 lb. fiber stress.

Standard Tube Co.
Detroit, Mich.
Circle **304** *on Time-Saver Card*

CHECK VALVES
. . . with straight thread ports

Features: SAE ports with O-ring seals provide easy assembly, insure against leaks. Large passages for full line flow, low pressure drop. Valve doesn't stick open, because



spherically lapped poppet eliminates close sliding fits. All parts are steel. Body is one piece.

Specifications: For service to 5000 psi. Burst pressure exceeds 10,000 psi. ¼", ⅜", ½", 1", 1¼" tube sizes available.

Fluid Controls, Inc.
Mentor, Ohio
Circle **305** *on Time-Saver Card*

HEAT EXCHANGERS
. . . in three series

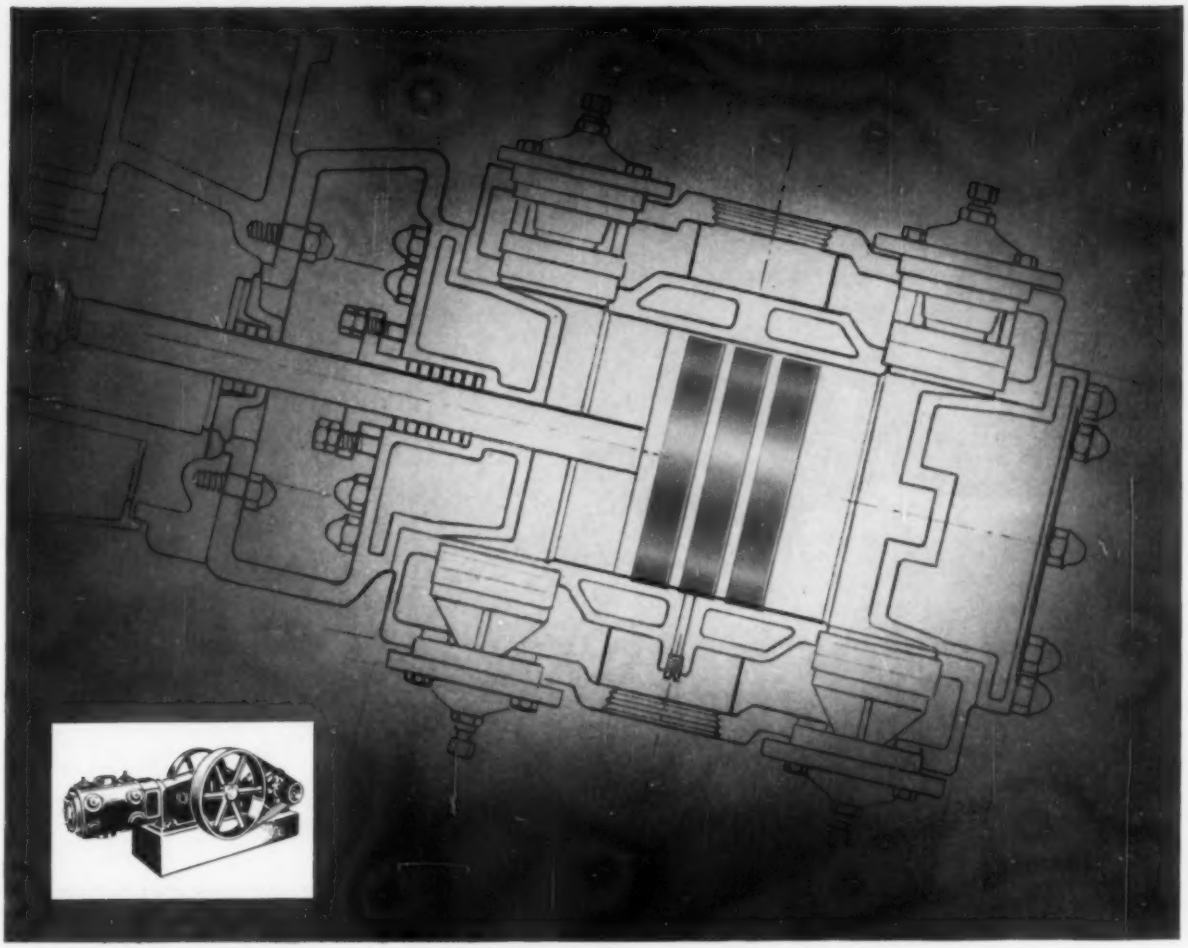
Designation: F-300, F-500, F-600 Series

Features: Four-pass heat exchangers need only one-half the water flow needed by a two-pass exchanger of the same diameter, both maintaining the same velocity.

Specifications: F-200 series remains available only in one-pass models. Four-pass models still include F-800 series.

Young Radiator Co.
Racine, Wisc.
Circle **306** *on Time-Saver Card*

Continued on page 56



Piston rings made with TFE resins cut replacement and maintenance costs

In a heavy-duty compressor, a set of piston rings and wear rings (shown above) made of a filled TEFLON TFE resin has made possible substantial savings in replacement and maintenance. The rings that were replaced by rings of TEFLON TFE resin cost two and one-half times as much, and lasted less than a week on the average. The rings made with the TEFLON TFE resin were still in operation after three and one-half years of service. According to the manufacturer, maintenance savings amount to approximately $3,750 labor/year/machine.

The unique combination of properties offered by TFE resins makes possible improved performance, greater reliability and lower costs in all types of floating-ring applications. TFE resins have the lowest static coefficient of friction of any solid material —less than 0.04. They eliminate problems of slip-stick, and permit the use of non-lubricated rings. In addition, their exceptional resistance to temperature extremes and their complete inertness to almost all chemicals and solvents make them ideal sealing materials under the adverse conditions often encountered in the hydraulic systems. In everyday seal applications as well, floating rings of TFE resins provide longer life, safer and more reliable operation and reduced maintenance costs.

Find out more about TFE-fluorocarbon resins and how they can lead to improved seals of all types. Write to: E. I. du Pont de Nemours & Co. (Inc.), Advertising Department, Room T-311, Nemours Building, Wilmington 98, Delaware—or consult your supplier.

DU PONT

TEFLON

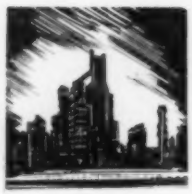
TFE-FLUOROCARBON RESINS

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

TEFLON is Du Pont's registered trademark for its fluorocarbon resins, including the TFE (tetrafluoroethylene) resins discussed herein.

FLUR-O-FRAN*

IT COSTS *LESS* TO GET *MORE* WHEN YOU BUY EXPERIENCE



Since 1947, when France first produced piston rings made from TEFLON† for hydraulic control cylinders, continuous research has kept France ahead in application engineering. It matters little whether your problem involves packing rings for a non-lube compressor, piston rings for compressor cylinders or piston rings for hydraulic applications. France can draw on vast experience with FLUR-O-FRAN in chemical, petrochemical, and in instrument air service, as well as the hydraulic field. Write today for full information.

* Trade Mark . . . FLUR-O-FRAN, a special compound of TEFLON and other materials, having unique properties—highly resistant to chemical attack—wide temperature range, −350°F to +500°F—extremely low coefficient of friction.

†Registered Trade Mark for du Pont FLUOROCARBON Resins

FRANCE PACKING COMPANY
9925 BUSTLETON AVENUE
PHILADELPHIA 15, PA.

Circle **57** *on Time-Saver Card*

NEW PRODUCTS

EXHAUST SHELL
. . . speeds up filter change

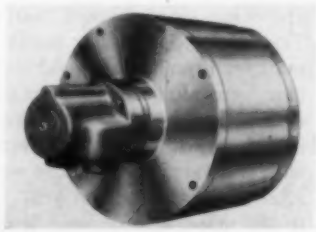
Features: Top of shell has quick action clamps for fast removal. With top removed, old filter can be replaced in a few minutes. Made of heavy gage steel, enamelled in grey tone.

Aget Manufacturing Co.
Adrian, Mich.
Circle **307** *on Time-Saver Card*

ROTATING AIR CYLINDER
. . . for speeds to 3600 rpm

Designation: Model RM

Features: Extra-long stroke provides more power for actuating chucks, collets, and other rotating holding devices. Double bearing inlet gives longer life at higher speeds and faster operating response. Inlet packing ajusts itself



automatically through working pressure. Housings and covers are precision-machined aluminum alloy. Low Weight and lessened flywheel effect reduce load on machine's motor.

Specifications: Bore sizes: 3" to 16". Draw bars to link cylinders to chucks available.

S-P Manufacturing Corp.
Solon, Ohio
Circle **308** *on Time-Saver Card*

Continued on page 60

WEATHERHEAD
fittings and hose assemblies
"MADE BETTER TO SERVE BETTER"

brass FITTINGS

⅛" to 1" sizes for pressures up to 5000 p.s.i. Approved by U.L., A.G.A., A.S.M.E., A.S.A. and S.A.E.

S.A.E. 45° Flare
Compression
Selfalign®
Threaded Sleeve
Inverted Flare
Pipe

forged steel FITTINGS

For flare and flareless pressure connections. Sizes ⅛" to 2" in carbon or stainless steel for pressures to 10,000 p.s.i.

Ermeto
Flare-Twin
S.A.E. 37° Flare
Pipe

bulk hose

Twenty different styles available. From ¼" to 2" O.D. for working pressures up to 10,000 p.s.i.

hose assemblies

Completely fabricated with permanently attached swaged ends. Any size, any quantity for working pressures up to 10,000 p.s.i.

reusable hose ends

Designed for fast assembly and positive, leak-proof performance under high pressures.

tube working tools

Designed for fast, accurate fabrication of all types of tubing layouts.

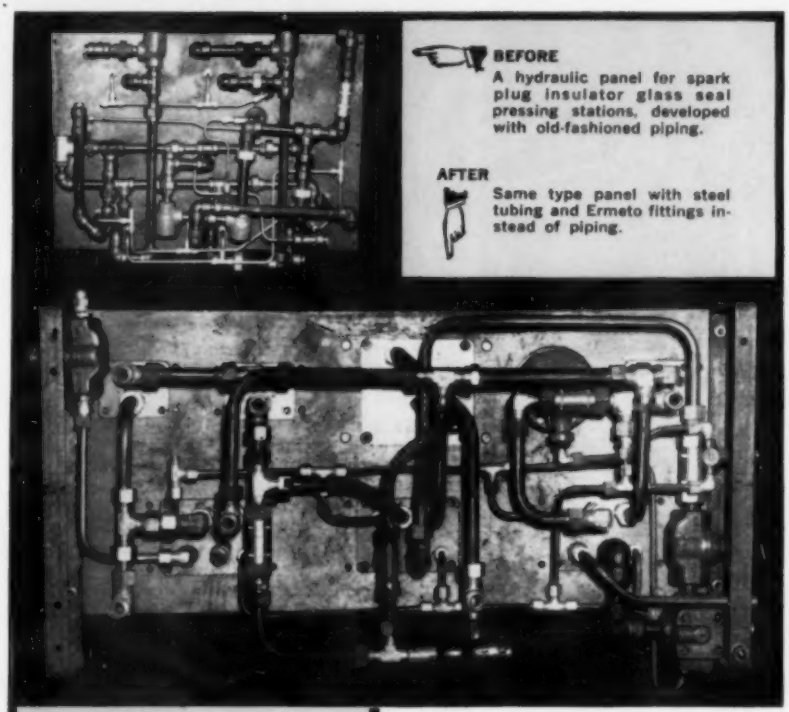
Tube Cutters
Tube Bending Springs
Mechanical Benders
Flaring Tools
Swaging Tools

Write for new general catalog—contains complete data and specifications for all items.

Screw machine parts made to your specifications . . . any machinable material. Write for information.

AWARD WINNING IDEAS...

"Ermeto Fittings Save $2000 Worth of Maintenance Labor Annually"



BEFORE
A hydraulic panel for spark plug insulator glass seal pressing stations, developed with old-fashioned piping.

AFTER
Same type panel with steel tubing and Ermeto fittings instead of piping.

Idea submitted by:
William T. Bayley
A.C. Spark Plug Division, G.M.C.
Flint, Michigan

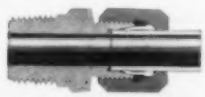
The photographs above show *before* and *after* views of hydraulic panels for a spark plug insulator assembly application which uses a petroleum base fluid operating under 700 p.s.i. at 115°F. Six machines were originally piped as shown in the *before* photograph. As Mr. Bayley states, "Considerable leakage at the many pipe threads was encountered, resulting in frequent maintenance. Oil leakage of these *before* units eventually resulted in operator injury.

"The *after* photograph shows one of the six panels repiped with Ermeto fittings and steel tubing. The results have been a 100% reduction of maintenance and oil leakage, reduced turbular flow, with a much neater installation operating at smoother and cooler rates.

"Ermeto fittings were selected because they were proved best from our tests. The superior grip on the tubing by Ermeto fittings survives shock and vibration, resulting in fewer leaks and less maintenance.

"The savings in maintenance of the six units *after* repiping amounts to approximately $2000 a year. This is chiefly in labor."

Find out how Ermeto fittings can help you reduce maintenance costs and improve system efficiency . . . *write today.*

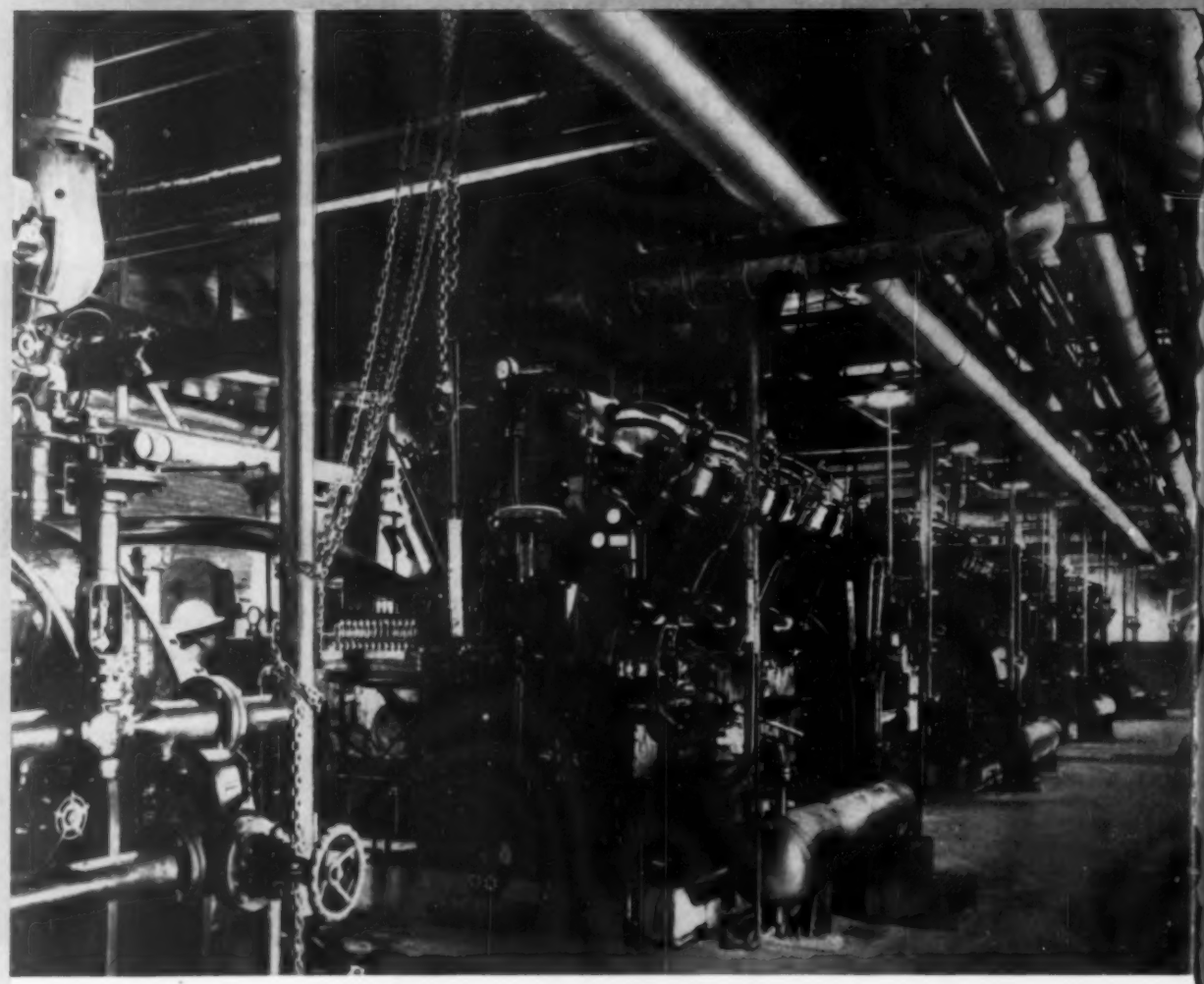


Ermeto hydraulic fittings are unmatched for positive high pressure control. Available in stainless or carbon steel with "Weathercote" or Cadmium finish in ¼" to 2" sizes.

BRASS & STEEL FITTINGS / HOSE & ASSEMBLIES / TOOLS & ACCESSORIES

WEATHERHEAD

THE WEATHERHEAD CO., FORT WAYNE DIVISION
Dept. AH-11, 128 W. Washington Blvd., Fort Wayne, Ind.
In Canada
The Weatherhead Co., Ltd., St. Thomas, Ont.



Cellulubes by Celanese minimize threat of fire

Protection of your personnel, plant and equipment against fire and explosion is a vital need. Cellulubes made by the Celanese Corporation of America can help you provide this protection. They resist the propagation of flame under conditions which could result in serious fires with other lubricants. And they give you so much more!

FM

Factory Mutual-Approved
(Cellulubes 150 and 220)

CELANESE CORPORATION OF AMERICA, CHEMICAL DIVISION
DEPT. 588-K, 180 MADISON AVENUE, NEW YORK 16, N. Y.

Please send me:

☐ Technical bulletin ☐ Sample of_____viscosity.

Name_____ Title_____

Company_____

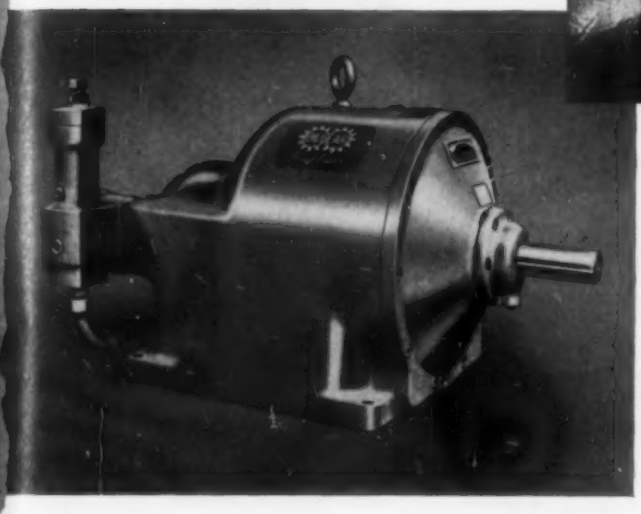
Address_____

City_____ Zone____ State_____

Application I have in mind_____

CYLINDER WEAR PROVED NEGLIGIBLE when fire-resistant Cellulubes were used to lubricate four Cooper-Bessemer air compressors, as two years' testing showed. Moreover, there were no pressure surges or evidence of fire in the air accumulator. Deposits normally found in compressor auxiliaries and valves were reduced or eliminated thanks to the detergent action of Cellulubes. Conventional lubricators could be used to pump the Cellulubes.

SAFETY, EFFICIENCY, COST SAVINGS are the advantages of Cellulubes discovered by Trunkline Gas Company Texas, after using these lubricant fluids for three years in their air compressors: Cellulubes eliminate risk to personnel from fire, explosion, fragmentation. Cellulubes do not get dirty or burn away by friction or compression. Cellulubes save on replacement costs, downtime, and maintenance. Cellulubes keep machinery smooth-running and clean.



USED FOR YEARS under rigorous conditions in pumps made by the Oilgear Company of Milwaukee, Wisconsin, Cellulubes provided superior protection against excessive wear. Cellulubes, which are phosphate ester synthetic fluids, can be employed in pumps at higher temperatures than fire-resistant fluids which contain water. They are suitable for use in all types of hydraulic pumps being used today, including vane, piston and gear pumps.

and explosion...protect machines against wear

For example, Cellulubes give overall wear protection comparable to that of premium petroleum oils. They present no foaming problem and have no additives which might deposit in the system. In fact, these synthetic lubricants and hydraulic fluids have a cleansing action inside machinery. Their vapor pressure is extremely low; this means that fluid losses are negligible even under severe operating conditions. Cellulubes are available in six viscosity ranges to meet all the standard needs of industry. Viscosity ratings do not change despite the toughest conditions of mechanical shear.

A pioneer in fire-resistant fluids, Celanese offers you years of field experience and research background to serve your needs. For more information on Cellulubes, mail the coupon to us today.

Celanese Corporation of America, Chemical Division, 180 Madison Ave., New York 16, N. Y.

Celanese® Cellulube®

Cellulubes... Celanese CHEMICALS fire-resistant functional fluids

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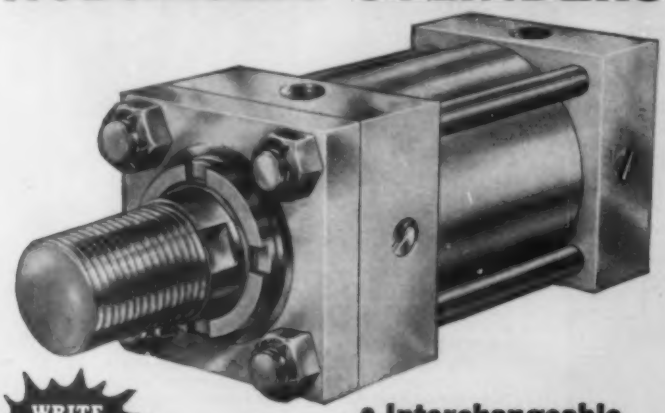
Circle **31** *on Time-Saver Card*

CELANESE CELLULUBES

For Smooth, Precise, Sure Power

SP NEW

HIGH-PRESSURE HYDRAULIC CYLINDERS



WRITE FOR CATALOG 117 TODAY!

- Interchangeable
- 100% J.I.C. Standards

2000 PSI (3000 PSI non-shock)

12 Bore Sizes: Compact 1⅛" thru 12"

Exclusive SP Features:

Quick Change Externally Removable Cartridge

Self-contained unit, easy to remove for servicing—no need to loosen tie rods or dismantle the cylinder.

"Clinch-Tite" End Seal

Maintains a leakproof seal at all pressures. An increase in internal pressure reduces the radial clearance at the pilot fit, eliminating "O" ring extrusion.

Interchangeable Cushion Adjustment and Check

Permits maximum installation flexibility; no clearance problem due to space-saving flush design; easy to adjust.

Heli-Coil® Insert Piston Lock

Permits quick, easy rod service without loss of thread strength; conforms to rigid aircraft standards.

A-766A

PROVEN QUALITY SP CYLINDERS · CHUCKS SPEED • PERFORMANCE

FREE Engineering Service
Representatives in principal cities
Phone or Write Today

Find us fast in the 'Yellow Pages'

THE S-P MANUFACTURING CORP.
30201 Aurora Rd. • Solon, Ohio

A BASSETT COMPANY • IN GREATER CLEVELAND • ESTABLISHED 1916

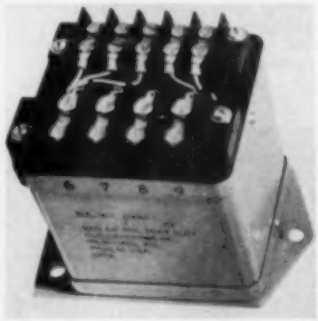
Non-Rotating and Rotating AIR and HYDRAULIC CYLINDERS • VALVES
POWER CHUCKS • COLLET and DRILL PRESS CHUCKS • ACCESSORIES

Circle **126** on *Time-Saver Card*

NEW PRODUCTS

OVERTEMPERATURE RELAY . . . for a-c applications

Features: Thermistor is inserted in windings of protected equipment; component responds only to temperature of equipment. Permits maximum use without danger of overheating. Fluid power applications include use with pump and



compressor drives. Relay device has magnetic relay, two transistor amplifiers, diode network for signal separation, voltage regulated power supply.

Specifications: Power supply ratings 110, 208/220, 440, 550 volts, 60 cycles. Pilot duty type contacts, 600 volts a-c maximum.

Cutler-Hammer, Inc.
Milwaukee, Wisc.
Circle **309** *on Time-Saver Card*

SMALL BORE CYLINDERS . . . are lightweight

Features: Designed for light holding, clamping, etc. Double acting or single acting with spring return.

Specifications: Bore sizes ¾", 1", 1½". Strokes from 1" in ¾" size to 10" in 1½" size. Maximum air pressure, 150 psi.

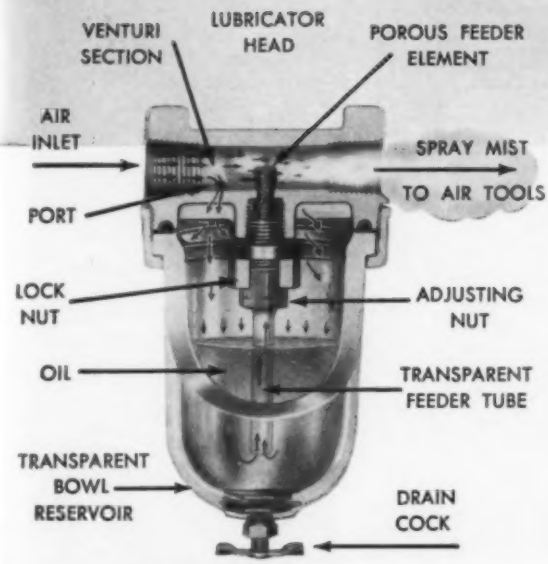
Baldwin Industrial Controls
Dartford, England
Circle **310** *on Time-Saver Card*

For more NEW PRODUCT reviews turn to page 131

Arrow AIRLINE SPRAY MIST LUBRICATORS

Supply a fine Spray Mist Lubricant by the most efficient and effective two-stage method!

By PRE-DIVIDING or breaking up the oil in the first stage before completely atomizing the Lubricant in the second stage. The Spray Mist is then carried along throughout the entire pattern of the air stream to lubricate the working parts of air-powered tools, cylinders, valves and other pneumatic devices.



Illustrates the operation of the ARROW "patented" two-stage, tamper- proof Lubricator.

Compressed air from the drop line enters the Lubricator to Venturi section of the Lubricator Head where the porous feeder element protrudes into the Air Stream.

Small ports in front of the porous feeder permits air pressure transfer on the oil surface in the bowl reservoir. The pressure differential created by the Venturi forces the oil to rise in the transparent feeder tube, into and through the porous feeder element which PRE-DIVIDES the Lubricant in this first stage, into minute particles of oil.

The Lubricant now finely divided and saturating the porous feeder element, is now easily and most efficiently atomized from the feeder element, at this second stage, by the action of the Venturi on the compressed air passing through the Lubricator Head.

The two-stage method incorporated in the ARROW LUBRICATOR insures a fine spray mist for wider ranges of AIR FLOWS at lower pressure drops.

Simplicity of design with only one tamper-proof adjustment provides for most efficient, low-cost operation.

PROTECT YOUR PNEUMATIC EQUIPMENT

Complete Conditioning and Control of Compressed Air Prolongs Service Life, Reduces Maintenance and Repair of Air-Powered Tools, Cylinders, Valves and Other Pneumatic Equipment.

the most Efficient and Complete AUTOPNEUMATIC CONTROL By Arrow

A choice of fine or coarse grade porous Bronze Feeder Wick as required for lubricant or application. A choice of Hand Filling Type Lubricator or a Pressure Filling Type with Button Head Fitting or the ARROW . . . New Fully Automatic Filling Type which with the Automatic Drain Trap makes Autopneumatic Control completely automatic, eliminating all hand or manual servicing.

Many Types and Models of Single Units and Units in Combination Assemblies to Meet Specific Requirements.

PIPE LINE SIZES—

¼"—⅜"—½"—¾" and 1" N.P.T.

Catalog and Engineering Data Sent on Request.

ARROW TOOLS, INC. 1934 S. KOSTNER AVE. CHICAGO 23, ILL.

USEFUL LITERATURE

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FILTER—REGULATOR—LUBRICATOR

In filter, centrifugal motion precipitates moisture and contaminants as small as 5 microns. Special cartridge removes them. Lubricator has atomizer operation: air goes through venturi jet where oil-drop is atomized. Additional air bypasses venturi, creates low pressure drop. A small portion of air goes to reservoir, creating higher pressure than in air stream. Circular 1014. *Wilkerson Corp., Englewood, Colorado.*

Circle **400** on Time-Saver Card

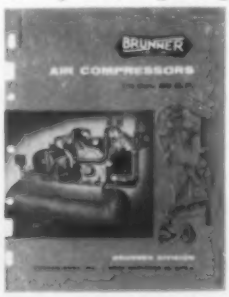
FILTER ELEMENTS & ASSEMBLIES

Bulletin describes seven basic filter element materials and series of filter assemblies and replacement elements. Materials discussed provide particle size control from ½ to 250 microns in temperature ranges from —350 F to 1500 F. Nine filter assembly and replacement element combinations illustrated with photographs. *Bendix Filter Division, Bendix Aviation Corp., Madison Heights, Mich.*

Circle **401** on Time-Saver Card

AIR COMPRESSORS

Catalog 36A covers single-stage and two-stage simple compressors and power plants, single-stage and



two-stage horizontal and vertical, tank-mounted outfits, single-stage, duplex outfits, and single stage and two stage electric motor and gasoline-engine driven, horizontal, tank mounted outfits. Engineering data section answers common compressor questions, contains selection charts, and a sample specification sheet. Drawings, dimensions, specifications. Also covers accessories. *Brunner Div., Dunham-Bush, Inc., West Hartford, Conn.*

Circle **402** on Time-Saver Card

GAGE ISOLATORS

Isolators prevent damage to fluid pressure gages and maintain gage accuracy. Four models cover 0-5000-psi pressure range. Data sheets contain engineering and design information. Schematic drawing, typical circuit applications, flow characteristics, JIC symbols, and dimensions. *Sarasota Precision Products, Inc., Sarasota, Fla.*

Circle **403** on Time-Saver Card

SELF-LUBRICATING PACKINGS

Internal lubrication seals against leakage. Packings have internal reserve of lubricant. Lubricant compounds are heated, forced under pressure into packing yarns. Four materials used: white asbestos, blue asbestos, cotton, and flax. Four stranded forms: braid over braid, plaited, interwoven, and twist. Wire-inserted, synthetic rubber-impregnated, and Teflon-impregnated packings available. Application chart and descriptions. Specifications. Tables on weights and lengths. Catalog SLP-659. *Greene-Tweed & Co., North Wales, Pa.*

Circle **404** on Time-Saver Card

HYDRAULIC ACTUATORS

Eight models have 1000-psi, 2000-psi maximum operating pressures, provide torque from 54 to 21,000 in. lbs. Use oil, air, gas, or water. Hydraulic pressures, applied to opposite ends of piston-racks operating simultaneously on opposite ends of meshed gear, equalize and balance. No drift to output shaft. Internally drilled portings. Entire unit is fully sealed and self-contained. Torque remains constant at any position throughout travel arc. Maximum operating oil temperature, 225 F. All moving parts are oil bathed by oil-filled center chamber, sealed from operating media. *Flo-Tork Corp., Orrville, Ohio.*

Circle **405** on Time-Saver Card

SOLENOID VALVES

Booklet has sections on nomenclature, valve sealing, and specification criteria: fluid characteristics, pressure, capacity, leakage,

speed of operation, and valve envelopes. Also included is information on solenoids, duty, electrical connections, and coils, application environment, testing, and safety. Drawings, schematics, and charts. 8 pages. *Valcor Engineering Corp., Kenilworth, N.J.*

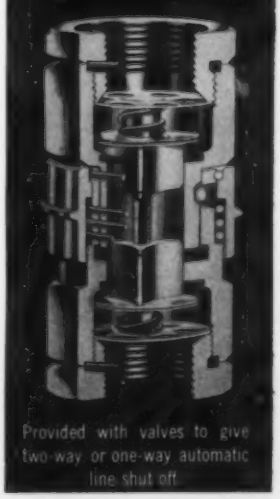
Circle **406** on Time-Saver Card

PNEUMATICS BOOKLET

Booklet App-6, 12 pages, has 43 photographs and case histories of original equipment applications, 24 illustrations of pneumatic principles used. Written to stimulate product engineering ideas. *Gast Mfg. Corp., Benton Harbor, Mich.*

Circle **407** on Time-Saver Card

Continued on page 64



Provided with valves to give two-way or one-way automatic line shut off.

Built to handle high pressure hydraulic and pneumatic systems

Snap-Tite *valved* couplings stop flow instantly"

Snap-Tite provides instant shut-off wherever fluid coupling is needed.

Snap-Tite *valved* couplings connect and disconnect quickly and fully—they automatically open line flow when connected; positively seal your line when disconnected—with no "ifs," no chance for human error.

Snap-Tite couplings are available in sizes from ¼" to 6" ID, in steel, brass, aluminum, 303 ss and 316 ss. Sizes from 6" to 10" ID are available on special order. For more information, write for Snap-Tite catalog #58. Snap-Tite representatives are located in all principal cities.

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USEFUL LITERATURE

HOSE GUIDE

Catalog for hydraulic hose users outlines low to high pressure hose specifications. Includes data on threads, fittings, and completed assemblies. 16 pages. *Hydraulics, Inc., Newark, N.J.*

Circle **408** on Time-Saver Card

POWER STEERING COMPONENTS

Torque generator, rotary servo control steering system, and high torque fluid motors are described in a brochure which suggests industrial, construction, and farm equipment applications. Torque generator has double shaft; output shaft duplicates movement of input shaft at speeds to several hundred rpm. Operates with very small torque signal applied to input shaft. High torque output is delivered through a servo valve and fluid motor.

Steering system is for vehicles requiring pressures to 1200 psi and flow rates from 2 to 6 gpm. It can be used with any remote actuator. Fluid motors which are shown have speeds from 10 to 600 rpm, torques to 2000 in. lb., pressures to 2000 psi. *Char-Lynn Co., Minneapolis, Minn.*

Circle **409** on Time-Saver Card

COUPLINGS

Fixed bore, flexible couplings machined from bar steel have steel drive pins, neoprene inserts. Bushed type flexible couplings discussed. Fixed bore flexible couplings are zinc alloy die cast. Bushed type rigid couplings machined from malleable castings. Sleeve couplings from bar steel. Chain couplings have solid steel sprockets with hardened teeth, are fitted with hollow head set screw. Maileable split taper bushings covered. Bulletin C-120-B gives complete specifications, rating charts. Coupling engineering data. *Browning Mfg. Co., Maysville, Kentucky.*

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SILICONE FLUIDS DESIGN FILE

File gives thorough compilations of mechanical properties of silicone fluids. Some graphs are on 17" x 11" sheets, enabling designer to work directly on them.

File is directed to design engineers in automotive, aircraft, rubber, plastics, rocket, and missile fields. It tells when and when not to use silicone oils. Registration card permits receiving additional sheets and revisions. *Silicones Div., Union Carbide Corp., New York, N.Y.*

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For more reviews of FREE LITERATURE turn to page 148

HOW MANY DROPS MAKE A LEAK?

Front Panel – Electrical Control Assembly

All-New CI LEAKMETER *Automatically Measures Hydraulic or Fuel Leakage!*

The measurement of leakage by counting or gauging drops is now obsolete! Convair Instruments' all-new LEAKMETER Model 400, when installed in a line between a pressure source and the system or component under test, will positively indicate, by a signal light, the presence of a leak, and will accurately measure its magnitude.

Operation of the LEAKMETER is automatic with a built-in timer which can be set for periods of 15 seconds to 5 minutes, providing a range for the instrument of 0.008 to 80 cc per minute. To measure other rates of leakage, or to test for sustained zero leakage, the timer may be overridden and the test conducted over any desired period.

PRINCIPLE: Fluid leakage is translated by a displacement transducer into a proportional electrical signal which is indicated in cubic centimeters by a meter housed in an electrical control unit. **EASE OF OPERATION:** The hydraulic transducer assembly is packaged separately from the electrical control assembly, permitting remote location. Both are designed for standard rack mounting. The hydraulic assembly is connected by quick-disconnect fittings.

COMPATIBILITY: The LEAKMETER is compatible with all common hydraulic fluids and fuels. Because both assemblies are isolated from the test environment, the item under test may be subjected to shock, vibration, or high temperatures. **TEST PRESSURES:** Accommodates test pressures to 5000 psi. **OPTIONAL READOUT:** Jacks are provided for recording or other readout. **PROVEN:** In use by leading manufacturers of high performance hydraulic equipment.

Front Panel – Hydraulic Transducer Assembly

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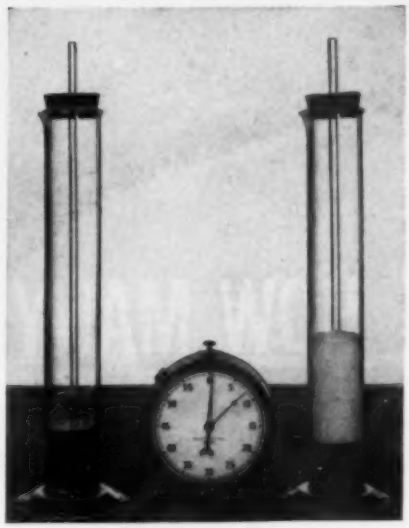
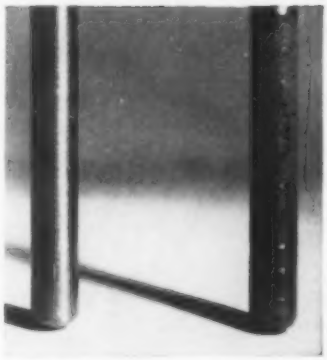
1,000-hour oxidation test shows that the coil (at left) immersed in Texaco Regal Oil R&O is free of the gum and varnish deposits which occur with an oil not fortified against oxidation (right coil).





ASTM Foam test shows that Texaco Regal Oil R&O has already depressed foam, only 480 sec. after air bubbles were forced through it. Severe foaming persists in cylinder of uninhibited oil at right.

In ASTM rust test, rust-free spindle was immersed for 24 hours in a circulating mixture of Texaco Regal Oil R&O and salt water. Severely rusted spindle (right) was run in same test using an oil not inhibited against rusting.

Here's why Hydraulic Performance is better with Texaco Regal Oil R&O

The tests pictured above show that you can count on Texaco Regal Oil R&O to give you the three vital properties you need in a hydraulic oil: oxidation resistance, rust prevention, and anti-foam action. These properties keep your hydraulic equipment performing predictably, dependably, every hour, every day with—

No unscheduled downtime due to corroded parts, no entrained rust particles to ruin precision machine parts, because Texaco Regal Oil R&O prevents rust.

Smooth hydraulic action, full or complete hydraulic power, because Texaco Regal Oil R&O resists foaming.

No expensive overhauls because of sludge or gum, because Texaco Regal Oil R&O gives long-lasting oxidation resistance.

For steady day-in day-out dependability of hydraulic performance, your best buy is Texaco Regal Oil R&O. For more information, contact the nearest of the more than 2,300 Texaco Distributing Plants, or write:

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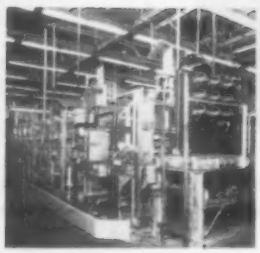
NOVEMBER 1959



How FIRE-RESISTANT fluids are used TODAY

. . . *an* APPLIED HYDRAULICS & PNEUMATICS *Staff Report*

TAKE identical machines. Fill them with the same fire-resistant fluid, and *according to the users,* hydraulic component life and performance may not be the same. A fluid that works in the Detroit plant may not give the same results in the Buffalo plant. Since the fluid and machine are the same, differences must be caused by variations in user practice.

This is the major conclusion you can draw from the interviews we are publishing this month. Our editors interviewed the engineers in automotive, steel, marine, die casting, and mining industries. We also surveyed more than 100 users by mail. Results of the survey appear in Chart I.

What were we after? We knew that diecasting machines consume at least 45% of the F-R fluids. Where's the rest of it used? What is user experience today? Will more plants switch to F-R fluids? The results are here, in story and chart.

As you read the interviews you'll find conflicting opinions. We consider that only natural. We think it means that industry is just beginning to find out how to use fire-resistant fluids. It also means that the fluid manufacturers still have work to do on their products.

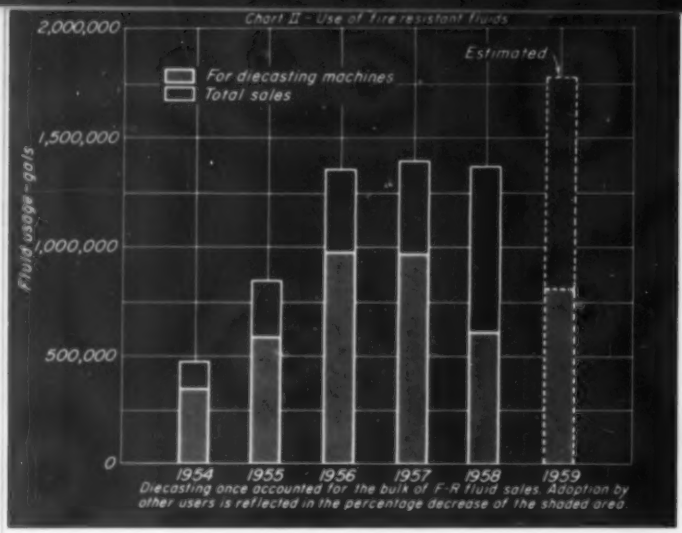
CHART I

APPLICATION OF FIRE-RESISTANT FLUIDS

Heat treating equipment	Plastic molding
Die casting	Missile handling
Aircraft controls	Missile testing
Lift trucks	Steel mills
Welders	Stamping presses
Casting furnaces	Foundry equipment
Marine handling	Forge presses
Marine controls	Glass works
Automotive assembly	Extrusion machines
Paper mills	Coal mines

FACTORS INFLUENCING SELECTION

Pump life	Packing Compatibility
Draining & flushing systems	Corrosion
Valve spool sliding friction	Toxicity
Paint removal	Viscosity change
Maintenance cost	Fluid cost
Insurance rates	Conversion cost
Performance of fluid	Service from supplier



TO SELECT YOUR F-R FLUID, YOU MUST KNOW. . . . .

1. DEGREE OF FIRE RESISTANCE OF THE FLUID
2. COMPATIBILITY WITH COMPONENT MATERIALS
3. CHARACTERISTICS OF THE SYSTEM (pressures, temperatures, etc.)
4. LEAKAGE RATE OF SYSTEM
5. EFFECT OF F-R FLUID ON COMPONENT OPERATION
6. EFFECT OF F-R FLUID ON MAINTENANCE

Compare these factors for each fluid, then decide on the basis of your own requirements.

CHART III — CHARACTERISTICS OF FIRE-RESISTANT FLUIDS

F-R FLUID	COMPATIBILITY OF PACKING MATERIALS								Viscosity SUS @ 100° F	Viscosity Index (approx.)	Flash Point °F	Fire Point °F	Lubricity	Thermal Stability	Cost relative to oil
	Butadiene	Acrylonitril	Neoprene	Butyl	Thiokol	Silicon	Fluorides	Polyacryl							
WATER & OIL EMULSION	Poor	Good to Excel.	Fair	Poor	Excel.	Fair	Excel.	Fair to Poor	350 to 450	140 to 360	varies with water cont.	varies with water cont.	Good	Good	2 to 3
WATER & GLYCOL SOLUTION	Good	Very Good	Good	Good	Excel.	Fair to Poor	Excel.	Fair to Poor	200 to 300	156 to 210	To 260 as sup.	To 270 as sup.	Poor to Excel.	Fair to Good	3 to 4
SYNTHETIC (PHOSPHATE) ESTHER	Poor	Good to Poor	Poor	Good to Poor	Good to Poor	Good	Excel.	Fair to Excel.	90 to 560	−30 to zero (max.)	To 535	To 600	Good to Excel.	Good	5 to 7

Information for this table was compiled from a survey of the field. Properties vary with the specific fluid and additives.

Above all, we think, the contradictions show that we lack knowledge of all sorts. Operating people lack long experience in using the fluids. They have been given too little technical information.

Nevertheless, sales of fire-resistant fluids are rising. The five leaders sold 1,363,000 gallons in '58. In the first half of '59 they sold 837,000. Chart II shows use of F-R fluids since 1954. Clearly this is a field one cannot afford to be uninformed about. Industry needs technical facts about the properties of fluids. Much has been written on the subject. The section on Design Data in the 1960/61 FLUID POWER DIRECTORY is helpful. So is Chart III above showing fluid properties. But properties of fluids aren't enough. That's why we made this study.

Insurance companies strongly recommend that F-R fluids be used where no sprinklers are available, whether the building is flammable or not. Insurance rates are lower if fire resistant fluids are used. Most fires result from high pressure lines which break and spray oil into hot, hazardous areas. Threaded sections, valves, copper or steel tubing pulling from its fittings, and rubber hose ruptured from repeated flexing and abrasion are all danger sources. Lack of adequate anchorage to prevent vibration and abrasion of piping is a big factor in sudden breaks. Die casting and automatic welding machines with their high pressures, constant movement, and ever-present ignition sources, have been the cause of most hydraulic oil fires.

In one year, one insurance company paid $1,049,000 in property damage and $133,000 for use and occupancy losses. During this period there were six fires in hydraulic systems on die casting machines causing $262,000 property damage and $5200 additional loss. Other losses were in seven other hydraulic fires, including one where the entire plant was lost.

If you have been planning conversion of your systems to use F-R fluids, information offered by industry in the following interviews will be most helpful. When you speak to fluid manufacturers, you will be armed with questions that affect *your* field. The manufacturer will then be better able to see your problem and advise you in selecting the proper fluid, making the proper allowances in system design.

DIE CASTING

Good housekeeping cuts F-R fluid troubles

• By KENNETH W. ZINTZ, *Hydraulic Engineer*

We have always prided ourselves on our plant housekeeping program, with preventive maintenance to avoid fires in our die casting shop. Furnaces with molten aluminum or zinc, mounted on or near the die casting machines were a fire hazard if a hydraulic line sprang a leak and sprayed petroleum fluid into the hot area. This happened one day, in spite of all of our precautions.

Thus, in selecting an F-R fluid, we had to consider the unit cost as well as the fluid's working and fire-resistant qualities. After analyzing our equipment and plant requirements, we chose water and oil emulsion for our machines.

• **Fluid maintenance**—Changing from oil to emulsion was no problem. We had only to drain and flush the systems, then refill with F-R fluid.

Separation of water and oil in systems occurs in less than 1% of the fluid that we use. When this happens, the fluid must be removed and replaced. Contamination is one of the leading causes of separation, although emulsions can carry heavier particles in suspension than petroleum oil. Water content is easily checked with a centrifuge. Water losses are not serious unless there is excessive fluid agitation in the tank. This can cause water loss as high as ¾ of 1% in 24 hours.

FLUID LEAK is pointed out by Kenneth Zintz. Switching to emulsion dropped the make-up fluid consumption by 75%, partly because of the brightly colored fluids early visual warning of leakage.

• **Better leakage control**—There was no real difference in leakage rates after the fluid change was made, but leaks are now repaired promptly because the emulsion's bright color makes a leak instantly visible.

In the past two years, emulsion fluids have been improved to a point where vane pump wear is acceptable in terms of replacement costs.

When fluid temperatures exceed 200 F for short periods, no damage occurs to equipment, nor does the emulsion deteriorate. Water content drops 2%, but the fluid retains all of its properties. Prolonged high temperatures woud probably deplete the water content, but leave the fluid in operating condition.

□□□

AUTOMOTIVE

Water-glycol powers foundry furnaces

• By DAN LENNOX,
Superintendent of Maintenance, Ford Foundry, Cleveland, Ohio

Safety is an important consideration in a large engine foundry such as ours. There are several hydraulically powered functions which would be extreme fire hazards if operated with conventional petroleum fluids. An electric furnace slags off close to hydraulic lines. Freight elevators handle hot materials. Four years ago, before converting to F-R fluid, we had a fire when a hot piece of shoe metal from an annealing furnace missed the container it was being put into, and dropped into a puddle of mineral oil which had leaked from the furnace hydraulic system.

To prevent such an accident again, we adopted water-glycol solution as our standard F-R fluid, to be used in two-thirds of all hydraulic systems in the foundry.

• **How we select a fluid** —Our decision was based on operating requirements, and a comparison of the three basic fire resistant fluids on the market. Water-glycol fluid is priced between the cheaper water-oil emulsions, and the higher priced synthetic esters. We found that pump life is 25% less with emulsion than glycol fluid. This is a measure of downtime, a serious consideration in an automated foundry. When we compared fire resistance, we found that the glycol would resist burning *after* removal from the immediate flame area, while the emulsion continued burning after leaving the flame. When you consider the fire hazard involved in the event of a high pressure hydraulic leak, the glycol seems well worth the extra cost.

In changing over to the fire-resistant fluid, we merely flushed out the systems thoroughly, and changed some screen sizes. There has been no noticeable change in the cost of maintenance since we converted to F-R fluids in 1956.

AUTOMOTIVE

Design machines for the fluid

• By C. J. BORUCKI
Tool Room Superintendent, Chrysler Corporation, Twinsburg, Ohio

In our stamping plant, 150 fluid power systems contain 15,000 gallons of fire-resistant fluid. In one installation a resistance welding line has a sparking hazard from 850 welds performed on unitized auto bodies. The welder units and transfer drives are all hydraulically actuated. We are fortunate that this plant is new enough to take advantage of F-R fluids from the beginning. The machines were designed with water and oil emulsion specified as the working fluid. Some fluid-soaked rags have ignited, but to date, we have had no major fires in the plant.

• **Equipment design**—Full attention must be paid to the shortcomings of a F-R fluid in the original design of the machines and in preventive maintenance, to take full advantage of this safety insurance.

By constantly monitoring our systems, we avoid the failures that can occur with the emulsion-type fluids. We found excess ring wear in vane pumps. At present, gear pumps have had a longer life than vane type pumps. In laboratory endurance tests gear pumps have been unaffected by emulsion. Oil and water separation would be a problem if we did not agitate the fluid by bubbling the new fluid drums with compressed air just prior to filling a system. If some separation occurs in the system after a prolonged time in disuse, the fluid can be restored by simply running the system for a short time.

Because pump cavitation is due partly to fluid contamination, we specified more filtration than normally needed, with the addition of a magnetic filter at the sump. Fluid samples are analyzed periodically, and faulty fluid removed from the system. Hydraulic supply systems are mounted on top of the machines to avoid contamination from dirt near the floor. Fluid temperature is controlled to about 120 F with heat exchangers, to insure against water loss by evaporation. Special corrosion-resistant paint is used in the tanks. To prevent power waste, each pump is unloaded during its idle cycle period. Seals and packings must be compatible with the fluid.

Economic factors influencing the selection of emulsion were its relatively low cost and reliability for our operating conditions.

□□□

MINING

F-R fluids are now in coal mines

Prepared from an interview with SAMUEL P. POLACK, *Bureau of Mines, Dept. of the Interior, Pittsburgh, Pa.*

Off to a slow start, but gaining momentum, F-R fluids are going into mining equipment. Cost of fluid has been the main deterrent to wide use in this industry, where each year an estimated 10 million gallons of all types of hydraulic fluid are used. Several important mining companies have started limited use of water-oil emulsions. These are available in both pre-mixed and concentrate forms.

Mining machinery operates in areas where headroom is often limited, ground is rough and unlevel, and lighting is poor. Repairs are usually made in the area where the machine operates. Severe duty heats up systems; leakage is common. Despite these adverse conditions, about 300 million tons of coal are mined annually by hydraulically actuated equipment.

• **How much hazard?**—A survey by the Bureau of Mines shows that in 59 mine fires investigated, 70% of them were attributed to flammable hydraulic fluids. A mine fire is not only a serious personnel hazard, but usually represents a total operating loss for many months. In an industry where costs have to be kept down, a low cost, fire-resistant fluid is imperative. At the moment, water-oil emulsions are gradually gaining acceptance as the answer.

ENDURANCE TEST RIG is shown by Sam Polack. F-R fluid is subjected to system test at high temperature to determine effect on pumps and other components used in mining machinery.

Laboratory tests were conducted by the Bureau of Mines using 40% to 50% water in emulsions, at temperatures to 190 F. After 1000 hours at 1000 psi pumps showed negligible wear. Field tests in actual mines indicate that these fluids perform well in mining machines and can be produced at a price acceptable to the industry.

Aside from safety and cost factors, a few side advantages were found as a bonus. Emulsions are light in

color . . . a brilliant warning of leakage in a dimly lit area. Operating temperatures are lower in many cases, compared with flammable fluids. Fluid manufacturers recommend that temperatures be held under 150 F.

To make F-R fluids practical for mining, the problems of viscosity, lubricity, stability, and corrosion had to be solved. In time, with continued acceptance, mine fires will be greatly reduced through the use of inexpensive, reliable, fire-resistant fluids.

Lubricity is problem in British mining fluids

• By COLIN M. FRYE,
Chief Test & Development Engineer, Dowty Mining Equipment Ltd., England.

Underground hydraulic systems using fire-resistant fluids have presented many problems. Some of these fluids have a detergent effect which tends to make contacted areas more vulnerable to corrosion. Cylinder rods which are alternately immersed in the fluid and then exposed to atmosphere, corrode faster. Some fluids separate out in use because of prolonged high temperatures and contamination from chlorides and some metals.

Swelling of synthetic rubbers is sometimes a problem. Continouus shearing action, as in a pump, can cause fluid instability. The fluid will not re-mix when recirculated and churned by the pump because the pump does not reproduce the original mixing conditions under which the fluid was compounded.

Until recently, water base fluids shortened ball and roller bearing life, especially in pumps with heavy loads. Fluid chemistry has improved this situation to where bearing life is as long as several thousand hours. In gear pump tests, where we get long life from bearings lubricated with petroleum base fluid, 75 hours was the total life using a water base fluid. Analysis of this test showed that mineral oil under high pressure has increased viscosity at the line of contact between roller and race.

This was not the case with the water base fluids, and consequently, the bearings deteriorated rapidly. Because of rough duty in the coal mines, leakage rates are higher than in equivalent surface units. This means that addition of fluid is necessary to keep proper level, and evaporation of water presents the problem of keeping proper proportions among fluid ingredients. Laboratory. testing to determine the proper mixture is difficult under mining conditions.

For the coal mines, I would say that we require a reasonably priced fire-resistant fluid which should be miscible with mineral oils with the same viscosity and lubricity. If such a fluid is not possible, then the next best thing would be suitable additives for water to give it the corrosion inhibition and lubricity that we require, and redesign the equipment to suit. Graphite suspensions have been tried to improve lubricity, but laboratory tests show that separation is still a problem with them. Ultimately, with the cooperation of chemists and users, a cheap, reliable fire-resistant fluid will be developed for use in the mines.

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INDUSTRIAL TRUCKS

If machines need F-R fluids, so do trucks

• By E. R. SIROTAC
Chief Research Engineer, Baker Industrial Trucks Div. of Otis Elevator Co. Cleveland, Ohic

Hydraulic systems on industrial trucks do not need the precise timing of machine tools, but they must work in all-weather temperatures, intermittently, and with a variety of load conditions. If the work area in a shop is sufficiently fire-hazardous to warrant a F-R fluid in hydraulically-actuated machinery, then the customer usually wants the same protection for his trucks. About 5% of our trucks are shipped with F-R fluid in their systems. From 8 to 25 quarts are required in each system.

Unless a customer specifies otherwise, we supply the water-glycol type of fluid. Without using any special packing materials or change in design, we have had no complaints from the customers about system performance. If the cost of this fluid could be substantially reduced, we would make water-glycol the standard fluid in all of our products.

Our experience with phosphate esters has not been as encouraging, but not too troublesome. In addition to higher fluid cost, we have the added burden of changing seals and packings so that they are compatible with the synthetic fluid.

As standard equipment in our truck systems, we use lead-lined tanks to prevent corrosion, and gear pump drives. This may account for the absence of tank corrosion and pump cavitation, regardless of which fluid is used.

An order for 16 trucks included the request for a synthetic ester F-R fluid because of operation as furnace charging trucks. We changed rings, packings and seals accordingly. In the past, the customer had experienced swelling when using steel-braided Neoprene hose with this fluid. This changed the hose inner diameter. We used a synthetic rubber inner hose with Neoprene and braid on the outside, and found it fully compatible.

MARINE

Shipboard fluids need wide temperature range

• By A. P. KNOX
First Engineer
S. S. Santa Paula,
The Grace Line
New York, N. Y.

Although the Santa Paula is a cruise ship operating in the Caribbean to Latin America, she carries cargo too. Twenty-two cargo ports (doors) lock watertight against the hull. The opening, closing, and locking of these ports are hydraulically actuated. Each port actuating system uses from 25 to 30 gallons of fire-resistant, synthetic ester fluid. The fluid was specified by the naval architects who designed the ship.

These port hydraulic systems work fine in the warmer months, opening and closing the doors in a few minutes. However, the low viscosity index of the original fluid made it thicken in winter, and it took as long as an hour to close and lock doors. The effect of outside temperature is immediate because the system is close against the ship's hull. Loading often occurs close to sailing time, so that if the doors work slowly, it could mean sailing delay, or sailing as the doors slowly close.

We also have an associated leakage problem because the crew sometimes gets impatient with the slow action and tries to close the doors with brute force, forcing fluid to leak through the seals. Sometimes the doors jam because one side closes faster than the other.

• **New fluid to solve problem**—The fluid manufacturer has recommended a variation of the fluid which has a wider temperature range—from 55 F to 200 F. We expect that when this change is made we will no longer have the slow motion problem.

Aside from this cold problem, we have had no troubles with either the system or the fire-resistant fluids aboard our ship.

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ALUMINUM

Alcoa uses lab tests and field experience to select right fluid

• By J. T. BUNTING and J. P. JENNY
Staff Mechanical Engineers,
Aluminum Company of America, Pittsburgh, Pa.

Aluminum manufacturing and its fabrication processes must often of necessity involve use of open flames, high energy electrical contacts and molten metal. For this reason, the use of fire resistant hydraulic fluids in certain equipment is an important safety precaution. At Alcoa, we use fire-resistant fluids in more than 500 hydraulic systems ranging in size from 30 to 4500 gallon capacity.

Our own laboratory constantly monitors all hydraulic fluids, checking their physical properties, chemical stability, and fire-resistant characteristics. These tests, together with field experience, help to determine which fire-resistant fluid we will use in a particular application.

The synthetic organic fluids are presently used for the most severe operating conditions. For those systems which will operate at more moderate temperatures, or for pumps which are not apt to contribute to the formation of rust, we make wide use of the water-base type of fire-resistant fluid.

Certain brands of synthetic organic fluids show an undesirable tendency to lose viscosity (at any given temperature) with use. They also display poorer viscosity-temperature properties than petroleum oil or the water-base fluids and some difficulty has been encountered in start-up when ambient temperatures are below 45 F. In such cases of cold start-up it has been necessary to install extra heaters to keep the system warm during idle periods.

We have experienced some rusting of reservoir tanks in the space above the fluid level when the water-base fluids were used. With existing equipment it is difficult to correct this situation. When new systems are being designed or purchased, this trouble can be minimized by holding the air space to a minimum or by constructing the tanks of non-rusting materials.

The fire-resistance of various brands of a given class of fluid are not identical and individual evaluations are desirable. It has been noted that the fire resistance of the synthetic-organic fluids decreases with decrease in viscosity.

• **Conversion practices**—Paints which are normally used in reservoirs that were expected to hold petroleum oil will very likely soften and contaminate the glycol-water or the synthetic organic fire resistant fluids. To avoid erratic operation and clogged suction screens, it is highly desirable to remove all paint prior to making a conversion.

Packings, seals, etc. compatible with petroleum oil are usually softened and are apt to swell when exposed to phosphate organic fluids. Cork or other water-absorbing packings will deterioriate if exposed to the water-base fluids. Replacement of questionable packings before making the conversion is usually sound practice, although taking a calculated risk and replacing only those packings which show obvious deterioriation may at times be justified.

Because the fire-resistant fluids have a strong tendency to dissolve sludge, varnish binders, etc., careful attention to system cleanliness before conversion will pay off in trouble-free operation. Cadmium plating will be dissolved by the water-base fluids and should be replaced before the conversion is completed.

STEEL

Synthetics lower maintenance costs

• By CHARLES A. BAILEY
Lubrication Engineer
National Tube Division, U. S. Steel Corp.

The introduction of fire-resistant hydraulic fluids to the steel and coal mining industries gave rise to extensive investigation in the field and laboratory. Surveys of the hydraulic systems within the company indicated that fire-hazardous states existed due to environmental conditions during certain operations; where such conditions occurred, a gradual conversion to fire-resistant fluids took place. Meanwhile, the laboratory conducted an evaluation study of available fire-resistant hydraulic fluids. Early in the testing program, it became apparent that system design had to be considered in order to fully evaluate the adaptability of a fluid to a particular system.

Laboratory tests produced the following preference rating (conditional to environmental state and system design), synthetic esters, water glycols, water-oil emulsions. Many marketed fluids tested attacked painted surfaces in the system and were adversely affected by petroleum oils; some fluids, due to either a foaming characteristic or a high specific gravity, caused pump cavitation. Lubricity and flammability varied among the fluids. Water-oil emulsions were unstable, caused vapor-phase corrosion, had an erratic viscosity, and presented field problems in low temperature installations. Water glycol fluids proved satisfactory at low temperatures and reduced leakage when a system was initially changed-over from a petroleum oil.

Synthetic esters, although the most expensive of the available fire-resistant fluids, proved to be practical for specialized purposes. The additional initial cost of special packings and seals could be considered insignificant when compared to the inherent advantages. This type fluid generally showed superior high temperature stability and lubricity, the latter resulting in excellent wear characteristics. Due to these features, maintenance costs can be lowered since down-time and the secondary cost of additives and servicing could be reduced.

□□□

RESEARCH

Viscosity index is an important F-R fluid feature

• By A. E. BINGHAM
Chief Research & Test Engineer
Dowty Equipment Ltd.,
Cheltenham, England

The perfect fire-resistant fluid has not yet been discovered, but tests and applications show that phosphate ester base fluids perform well if kept within a reasonable temperature range. Glycol and water fluids lose water content and are poor lubricants for anti-friction bearings. With a petroleum fluid, viscosity increases with pressure, spreading the pressure area on the ball race, and reducing the risk of spalling.

Temperature range is another limiting factor in the water-glycol fluid applications. Even with the phosphate ester fluids, the necessity for butyl rubber seals places an upper temperature limit on practical use of the fluid. Paint removal is still another problem with synthetic fluids. Epoxy resin-based paints now in development promise good resistance to these fluids.

Some fluids attack electrical insulation, and wires must be nylon coated to resist this. Silicate esters often deteriorate on mixing with water, so condensation should be avoided in the reservoir.

Viscosity index is most important. Not only is viscosity lost with higher temperature, but with prolonged use, as well. At low temperatures, the fluid may thicken excessively, but some esters work well down to —30 S. Other factors to consider are density, toxicity ,shear breakdown, and compatibility with water. Flash point, fire point, and spontaneous ignition temperature are factors in the fluids fire-resistance. One of the most important factors in selecting a fire-resistant fluid is the cost. Not only must the cost of the fluid be considered, but the extra cost of elastomeric seals for compatibility must be added.

Fire-resistant fluids represent a small, but growing percentage of the total hydraulic fluid consumption in Britain. Many of the problems with these F-R fluids will have to be resolved by chemists of the fluid and elastomer industries, before acceptance can be widespread.

□□□

PACKING MATERIAL CHARACTERISTICS

Packing Material	Fluid Compatibility	Temperature Range	Remarks
Natural Rubber (NR)	Not good for petroleum base or synthetic fluids. Good for water base.	Good at low temperatures and up to 200° F	Excellent water resistance. Many blends are compounded to suit specific requirements. Cost: low
Styrene (SBR)	Not good for petroleum base or synthetic fluids. Good for water base.	Better heat resistance than natural rubber	Characteristics are similar to natural rubber. Cost: low
Chloroprene (CR) (Neoprene)	Fair for water base and petroleum fluids.	−65 to 250° F	Swells excessively in most synthetics. Releases traces of chlorides at 250 to 360° F that cause corrosion under static conditions. Cost: medium low
Nitrile Rubber (NBR) (Buna-N) (Hycar)	Good with water, aliphatic base petroleum oils and some synthetics.	−65 to 250° F	No corrosive tendencies. Swells excessively in aromatic oils and many synthetics. Cost: medium low
Butyl Rubber (IIR)	Good with water and some synthetics. Not good with petroleum base oils.	−65 to 250° F	Best choice for pure phosphate ester fluids. Cost: low
Polyacrylates (Hycar 4021) (Vyram)	Not good with water base fluids. Good with some synthetics.	0 to 350° F	Becomes brittle at temperatures below 0° F. Cost: high
Silicone Rubbers	Good with water. Fair with petroleum oils. Good with some synthetics.	−120 to 500° F	Weak in tension and abrasion. Not suitable with silicone fluids. Cost: medium high
Fluoro-Silicone (LS-53)	Good with water, oils and some synthetics.	−120 to 500° F	Tensile and abrasion resistance low but better than regular silicons. Good resistance to silicone fluids. Cost: very high
Polysulphides (Thiokol)	Good with water, petroleum base fluids and most synthetics.	10 to 160° F	Brittle at temperatures below 10°F. Will vaporize at temperatures above 160° F. Poor resistance to cold flow. Lacks rubbery characteristics. Cost: high
Fluoro-elastomers (Viton-A)	Good with water, petroleum base fluids and most synthetics.	−20 to 500° F	Not satisfactory on phosphate esters Cost: very high
Fluoro-Plastics (Teflon) (Kel-F)	Good with all fluids.	−320 to +500° F	Relatively hard & rigid. Low friction. Cold flow under high loads. Excellent chemical resistance. Cost: high

RECOMMENDED PACKING MATERIALS FOR FIRE-RESISTANT FLUIDS

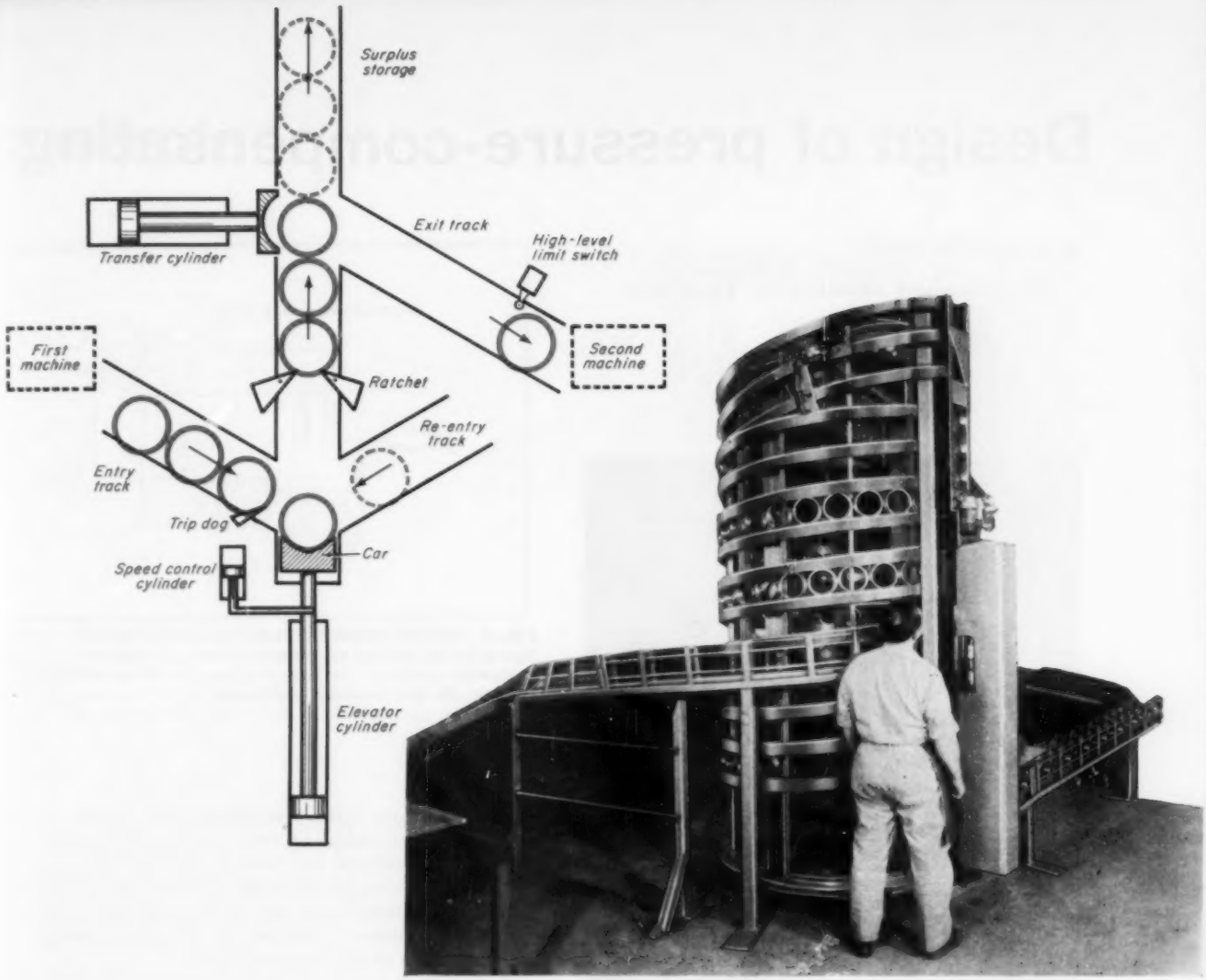
Fluid	Packing Material	Remarks
Water-glycol solution	Natural Rubber	Fluid additives to increase lubricity, reduce corrosion, and improve viscosity index are usually not injurious to natural rubber.
	Leather (treated to resist water)	
Phosphate Ester (Skydrol 500, Pydraul F9, Cellulube 220, Houghto-safe 1120)	Butyl Rubber Silicone Rubber	Both good. Butyl usually more economical.
	Leather impregnated with Thiokol	Limited temperature range.
	Vyram	Relatively high cost. Cannot be reinforced. Limited low temperature range.
	Braid with soap-glycerine lubricant which will not wash out.	For valve stems.
	Braid lubricated by impregnation with Teflon suspensoid.	For valve stems. Superior to soap-glycerine lubricant.
Silicate Esters (Skydrol OS 45, Oronite 8515 and 8200)	Nitrile Rubber Chloroprene Rubber	Same types of packings as in natural rubber are available.
	Polyacrylate Rubber	Available in O-rings, V-rings, U-rings, cups and flanges. Unsatisfactory at low temperatures.
	Leather impregnated with Thiokol.	Satisfactory at moderate temperatures.
	Braid impregnated with Teflon suspensoid.	Best for valve stems.
Chlorinated Hydrocarbons (Aroclor 1248 or 1254)	1F4 Rubber, Vyram	Preferred materials.
	Silicones, and leather impregnated with Thiokol.	Fair.
	Braid impregnated with Teflon suspensoid.	Best for valve stems.
Silicone Base	Nitrile Rubber.	Compounding must be special to avoid shrinkage.
	Vyram.	Shrinkage problems worse than Nitrile.
	1F4 Rubber (formerly Poly FBA)	Good but very expensive.
	Braid impregnated with Teflon suspensoid.	For valve stem packing.
Water-oil Emulsion	Nitrile rubber.	Nitrile resists both oil and water.
	Packing should be selected by testing various rubber materials.	Stabilizers added to the fluid make packing material difficult to select.
	Braid impregnated with Teflon suspensoid.	For valve stem packing.

Packing materials for F-R fluids

• By E. W. FISHER

Manager
Product Engineering Department
The Garlock Packing Co., Palmyra, N.Y.

MANY of the materials shown on these tables are special and somewhat expensive. They are not usually found on a stock room shelf. The requirement for such materials would usually result from unusual conditions or fluids. Where this exists, the problem of both the fluid and the packing should be considered early in the design program so that special rubbers and/or compounds can be made and evaluated against the proposed fluid. Without proper planning, a lot of costly hydraulic fluid can be lost through leaky packing caused by improper selection. □□□



Automate your parts feeding

• By FELIX ZAWASKI, *Plant Manager, Gear-O-Mation Div., Michigan Tool Co., Detroit, Michigan*

IF YOU have to transfer small parts from one machine to another, a simple way is a track system controlled by air cylinders. In this equipment (designed and built Gear-O-Mation division of Michigan Tool Co.) two air cylinders normally feed parts one by one from the first machine to the second machine. If the second machine is not operating, the system stores parts in the circular tracks.

Here's the sequence when both machines are operating or when either is operating alone. The trip dog in the entry track is actuated by the elevator cylinder moving down. This releases one part to the car which pushes it up through the ratchet dogs where it is held. The transfer cylinder, which is actuated by the high level switch in the exit track, pushes a part into the exit track when the limit switch is not actuated by a part.

If the second machine is not operating, parts are pushed up into the surplus storage unit where they roll down through the re-entry track to the car. If the first machine is not operating, the elevator cylinder raises parts from this re-entry track until the surplus storage system is emptied.

• **Air-oil speed control**—The 3¼-in. elevator cylinder extends through a 7-in. stroke. To limit its speed and prevent it from jolting the parts, its rod is connected to the rod of a 1½-in. cylinder which moves with the elevator cylinder. This small cylinder is connected in a closed hydraulic system. It forces oil through a flow control valve when the elevator cylinder extends. The setting of this valve then adjusts speed of the parts traveling upward. □□□

Design of pressure-compensating

• By WALTER ERNST
Vice President & Director of Engineering
The Commonwealth Engineering Co., Dayton, Ohio

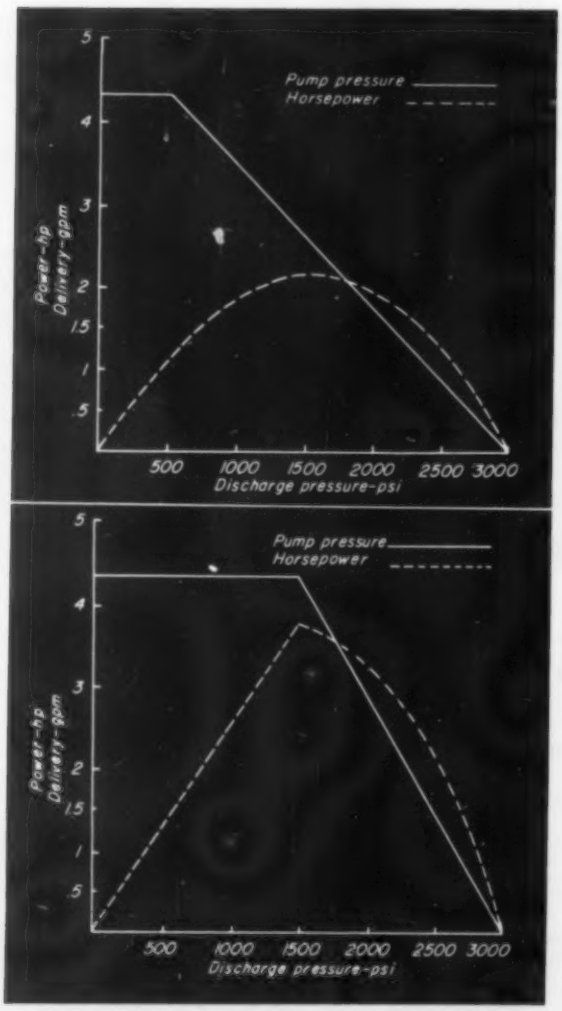


FIG. 1. POWER AND DELIVERY plotted against discharge pressure shows the power saving with pressure-compensation. A fixed displacement pump delivering 1000 cipm, (4.2 gpm) at 3000 psi requires 7.5 hp. The top curve shows a cutoff pressure of 500 psi. Power consumption increases until the pressure reaches 1500 psi. The bottom curve is for a cutoff pressure of 1500 psi.

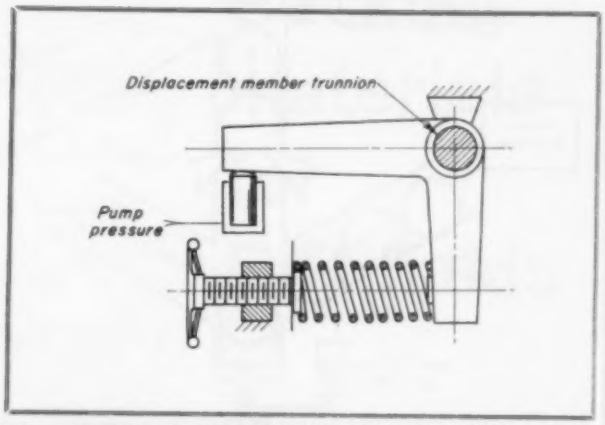


FIG. 2. SPRING-LOADED, PRESSURE-COMPENSATING control. Spring force, tending to increase delivery, is opposed by pump discharge pressure on the plunger. As pump pressure increases, its displacement decreases.

OUTPUT from many variable-delivery pumps is adjusted by sliding or rocking the pumping element. This movement increases or decreases the element's eccentricity, which raises or lowers pump output. Pump manufacturers use various controls to adjust and maintain volume setting. A pressure-compensator is the most common control.

A pressure-compensated pump maintains a preset pressure in a press or other hydraulic system with only enough delivery to compensate for leaks. Considerable power is saved because the pump delivers only the volume called for by the system.

• **Operation**—Figure 2 shows an arrangement in which a fixed pressure from a spring or hydraulic cylinder forces the pump stroking members toward delivery position. This force is opposed by a hydraulic plunger pressurized from the pump discharge. As pump pressure builds up, the plunger moves and gradually overcomes the resistance of the fixed-pressure spring or cylinder. Increasing pressure forces the pump toward neutral or no delivery position. The two forces balance at a point where just enough fluid is pumped to retain system pressure against the fixed resistance.

Initial or preset tension of the spring determines maximum cutoff pressure. That is the pressure at which the displacement of the pump begins to decrease. The spring gradient determines the peak pressure of the pump when the displacement reaches zero.

Figure 1 shows pump characteristic curves for different spring gradients and constant terminal pressure.

• **Power saving**—With a fixed displacement pump, the maximum power input is at maximum pressure.

controls

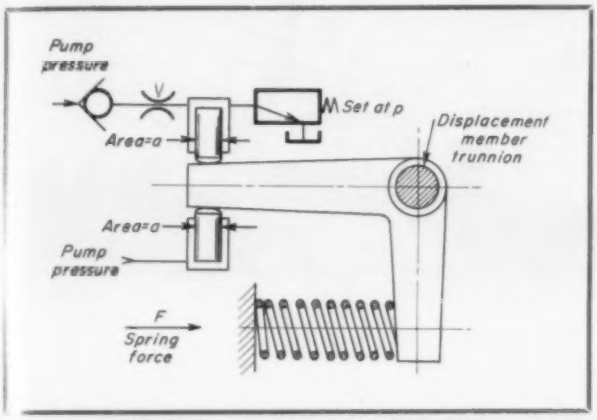


FIG. 3. COMPOUND PRESSURE-COMPENSATING control. Spring size is decreased by using a plunger, pressurized by pump discharge, to augment spring force. A relief valve maintains constant pressure on the plunger. Cutoff pressure is changed by varying the area of the control plunger.

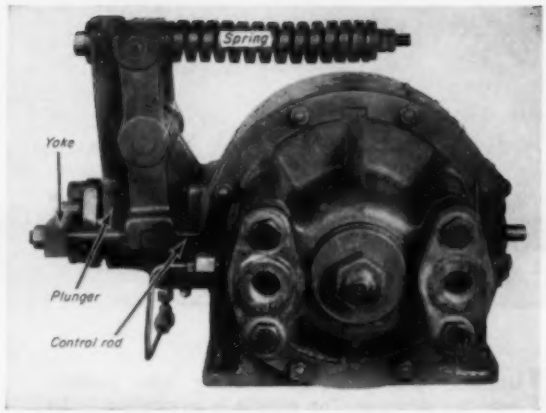


FIG. 4. A SIMPLE SPRING-LOADED PRESSURE control on a radial piston pump. Two rocking levers mounted on a fixed fulcrum are attached to the pump casing. Rods extend through the casing and attach to the internal stroke cross-head of the pump. The rocking levers move the rods because of the preset tension of the spring. The hydraulic plunger mounted in the pump control bracket connects to a yoke which moves the rods. The plunger is pressurized from the pump discharge. Spring gradient determines the cutoff pressure. A compound pressure-compensator could use a smaller spring.

Courtesy American Engineering Co.

In a pressure-compensated pump, when the cut-off pressure is less than one-half the maximum pump pressure, peak power is consumed at one-half maximum pressure. If pressure at the cutoff point is greater than one-half maximum pressure, peak power is consumed at the cutoff point.

The formula for peak power with cutoff pressures less than one-half maximum pressure is:

$$P_{max} = \frac{Q_{max}\ (p_{max})^2}{4(p_{max} - p_c)} \quad \ldots\ldots (1)$$

where:

P_{max} = Maximum power required in in.lbs/min
Q_{max} = Maximum pump volume in cipm
p_{max} = Maximum pump pressure in psi
p_c = Cutoff pressure in psi

For higher cutoff pressures:

$$P_{max} = Q_{max} p_c \quad \ldots\ldots (2)$$

• **Compound control**—In some applications pump output must be maintained at maximum value as close to maximum pressure as possible. With an ordinary spring-loaded control this would require a long spring with a very steep spring gradient. However, a compound pressure-compensating control will do the job with a much shorter spring.

The compound control, Figure 3, has a control plunger which maintains a constant force in the same direction as the spring force. The plunger is pressurized from the pump discharge. A relief valve maintains constant pressure, and a check valve prevents pressure drop when pump pressure decreases. Opposing this force is another plunger actuated by pump discharge pressure.

In a compound pressure-compensating control, the relation between pressure, spring force, and plunger area is:

$$p_c a = F_{min} + pa \quad \ldots\ldots (3)$$

$$p_{max} a = F_{max} + pa \quad \ldots\ldots (4)$$

where:

p_c = Cutoff pressure
a = Area of the plunger
F_{min} = Preset spring tension
p = Relief valve setting
p_{max} = Maximum pump pressure
F_{max} = Maximum spring force

Combining formulas 3 and 4:

$(p_{max} - p_c)a = F_{max} - F_{min} = \Delta F$ = Spring gradient
$p_{max} - p_c = \Delta p$ = pressure differential

For example, assume that a maximum pressure of 3000 psi is desired, with a differential pressure (Δp) of 300 psi. Assuming a spring force of 300 lbs is required for mechanical reasons, a gradient (ΔF) of 150 lbs or 50% is selected. The area of the plunger is then;

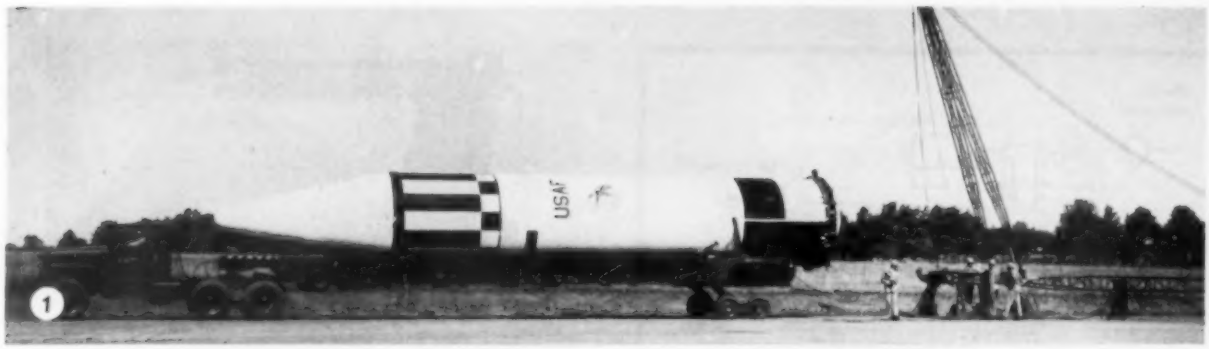
$$a = \frac{\Delta F}{\Delta p} = \frac{150}{300} = 0.5 \text{ sq in.}$$

and

$$p = p_{max} - \frac{F_{max}}{a} = 3000 - 600 = 2400 \text{ psi}$$

With a simple spring-plunger control, F would be 30 lbs, and would require a spring five times as long as that with the 150 lbs gradient and the compound control. □□□

Here's how fluid power

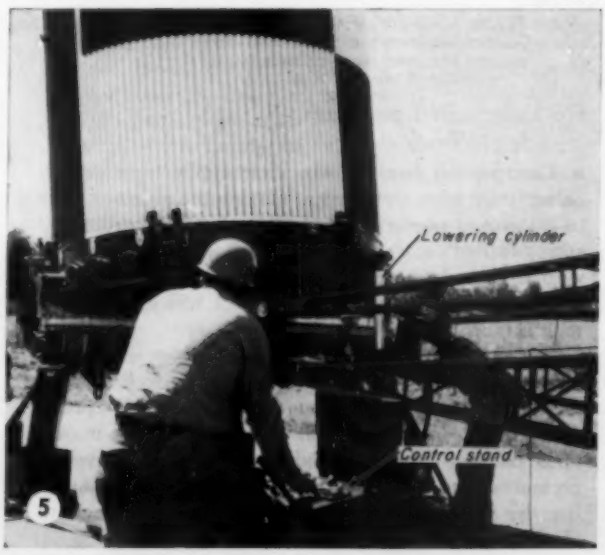


1 **MISSILE TRANSPORTER** backing into position near the launcher. The missile is in position to be loaded on the launcher. It has been raised and moved back by the cylinders at the rear of the transporter.

2 **HYDROPNEUMATIC TRAILER** carries the controls and valving for both the hydraulic and pneumatic ground support equipment. Nitrogen is stored at 5000 psi and reduced to 3000 psi and 750 psi for missile pneumatic systems.

3 **REAR WHEELS** of the missile transporter are suspended with two hydraulic cylinders. A manual 4-way valve extends the cylinders and raises the transporter chassis. The chassis is raised to help engage the missile to the missile launcher.

4 **REAR OF THE LAUNCHER TRANSPORTER** showing two of the four hydraulic cylinders for adjusting wheel suspension. Connections from the top and bottom of the cylinders lead to hydropneumatic accumulators for absorbing road shock.



5 **HYDRAULIC CYLINDER** cushions the fall of the missile from the point of balance in erection to its final position on the launcher. A portable valve stand controls the cylinder.

6 **750-PSI PNEUMATIC PRESSURE** disengages this connector's locking device (center), just prior to launching. At the same time the three pistons, between the electrical connectors, are pushed out. The coupling then separates from the missile.

7 **FOUR-WAY ROTARY VALVES** control raising and lowering of the two front wheels on the launcher transporter. The transporter is lowered and pulled clear once the launcher is in place.

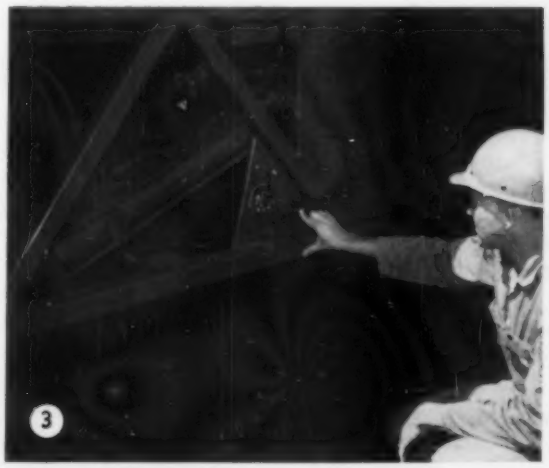
handles the Jupiter

THREE mobile trailers carry the ground handling and servicing equipment for the Jupiter missile. They consist of a hydropneumatic trailer, launcher transporter, and missile transporter.

The hydropneumatic trailer provides pneumatic and hydraulic pressures for the missile while on the ground and pneumatic pressure for the ground fuel and liquid oxygen transfer valves. It pressurizes the missile high pressure spheres, ground motor starting system and missile liquid oxygen tank just prior to launching.

Nitrogen is stored at 5000 psi in reservoirs and reduced to 3000 psi and 750 psi for the missile pneumatic systems.

A 3000-psi, variable-volume, piston pump furnishes the hydraulic power for actuators on the missile and launcher transports. It also supplies pressure to the missile hydraulic system before launching. □□□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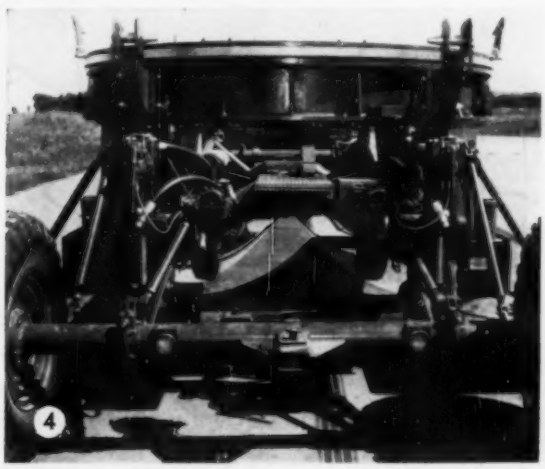
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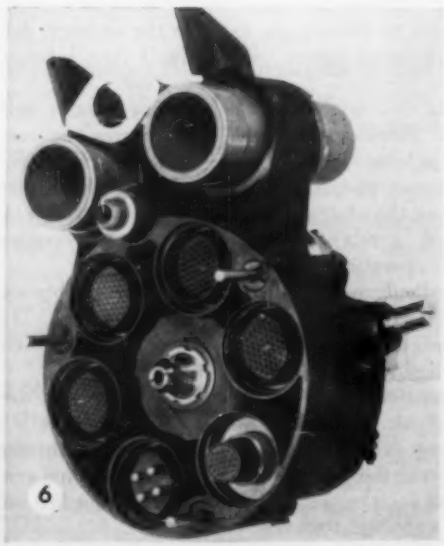
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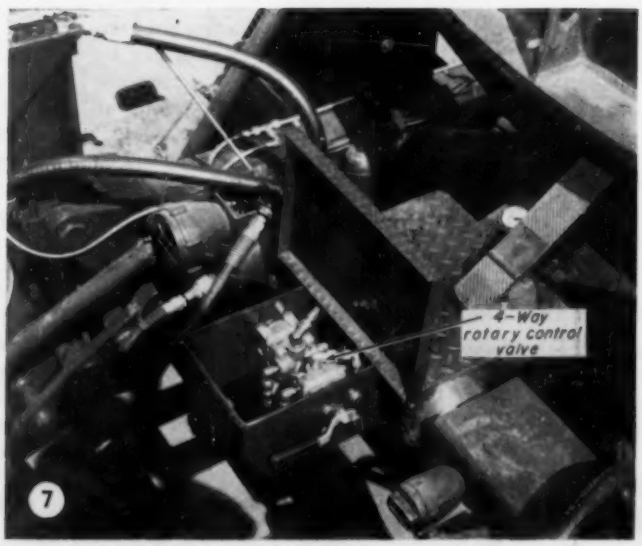

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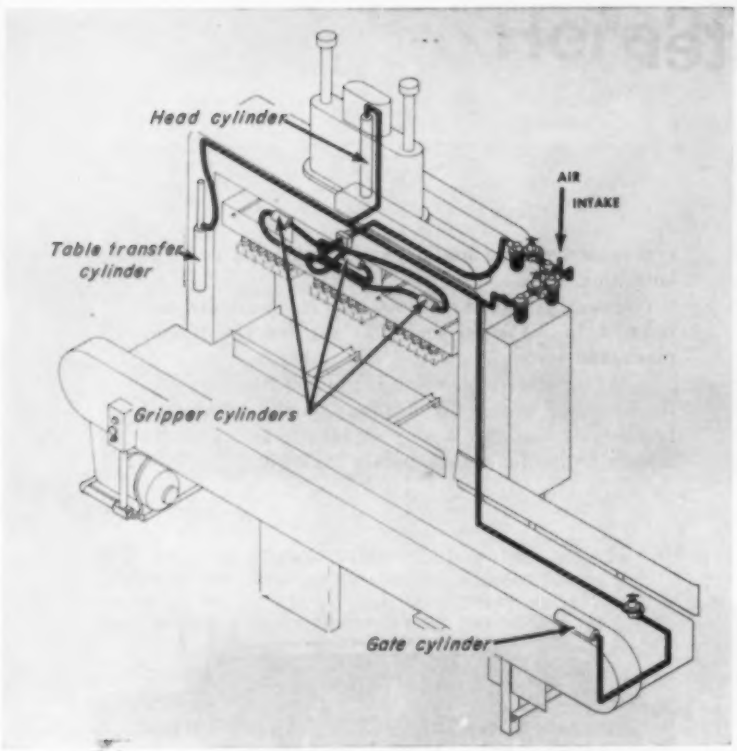
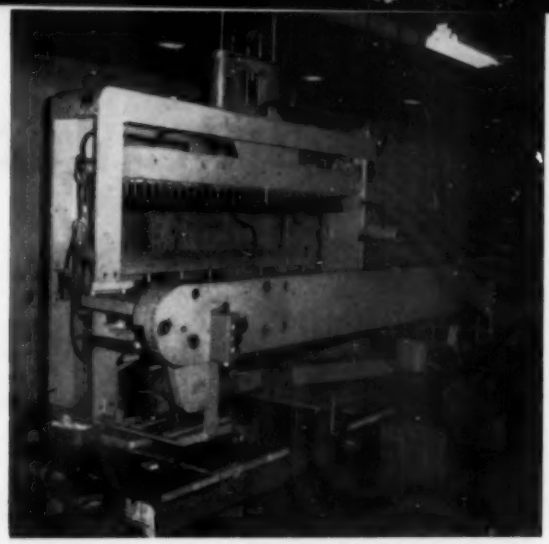




PISTON ROD OF THE TRANSFER table cylinder connects to a rack which drives a pinion gear. A gear rotating with the pinion shaft drives a rack attached to the transfer table. As the piston extends the table moves in. A hydraulic check on this cylinder gives smooth operation.

REGULATING VALVES give three different pressures for circuit requirements. Solenoid control valves are built into the cylinder end caps to reduce piping.

Timed air circuit speeds bottle handling

• By MILTON B. QUITZOW, *Asst. Chief Engineer, Barry-Wehmiller Machinery Co., St. Louis, Mo.*

IN a modern beverage plant empty bottles must be handled fast. The speed at which empties can be uncased, washed, sterilized, and refilled determines the inventory of bottles needed. Uncasing is one of the most difficult operations to mechanize.

Engineers at Barry-Wehmiller called on pneumatics to handle the complicated positioning and lifting motions required in their case unloader.

Air cylinders perform four operations on the uncaser. One opens and closes a gate which lets cases on the machine conveyor. A table transfer cylinder moves the cases under the bottle gripper heads, while another cylinder lowers the gripper heads and lifts the empty bottles from the case. An air cylinder also opens and closes the bottle grippers in each head.

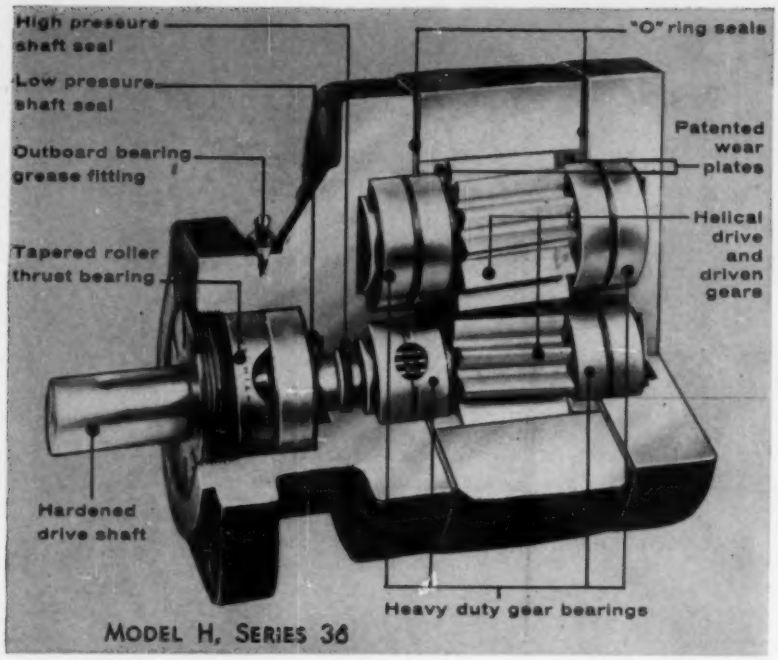
• **Electrical controls**—Limit switches and timers sequence the operations. A chain and sprocket from the main conveyor powers four cam-operated limit switches. These switches control positioning the case under the bottle gripper heads and opening and closing the gate to allow more cases to the uncaser. Adjustable electrical timers control dwell time between operations.

A photo cell circuit on the machine assures safe operation. Blocking the light beam moves the case positioning table out or lifts the bottle gripping units up, whichever operation is next. The machine then stops. When the obstruction to the photo-electric beam is removed, a relay closes and the uncaser resumes automatic operation.

• **Air cylinders**—All air cylinders are double-acting and controlled by 4-way solenoid valves. The valves have built-in throttling adjustments to regulate speed in both directions.

The transfer table cylinder has an integral hydraulic check to control the *IN* stroke. The *IN* stroke must be smooth to avoid jarring the bottles while moving them under the gripper heads, and prevent breaking the uncased bottles being pushed off the back onto the discharge conveyor. □□□

How to get top performance with Fluid Power Pumps



MODEL H, SERIES 36

Internal alignment perfected

Mass production of independent gear pump housing parts invariably results in varying degrees of internal misalignment—regardless of dowel pin control points used in machining. In many cases the "out" for the problem involves a loosening up on the internal tolerances—with a resultant loss in efficiency.

At Commercial, the patented thrust plate serves as a "natural" alignment control point—is counter bored on its face to match the bearing sleeve, then fits over the bearing sleeve and in turn pilots inside the gear housing. Perfect internal alignment—and increased efficiency—in any Commercial oil-hydraulic pump is axiomatic with rigid inspection of the thrust plate alone.

Constant volume assured

The principle of automatic adjustment of end clearance by internal pump pressure had one main weakness. The full pump pressure was applied against the whole area of each thrust plate. The plates would wear unevenly because on the inlet side of the pump the plate had full pump pressure on one face and a vacuum on the gear side.

By "pressure pocketing" Commercial insured that the pressures on opposite faces of the thrust plates would be in approximate balance around the entire area of the plate faces. Commercial's "one-two" advance design punch—the patented "pressure pocketed" thrust plate—assures constant volume at any pressure and at the same time helps to maintain simplicity of design and soundness of construction . . . provides for longer operating life and no maintenance headaches.

Oil leakage controlled

In any method of mounting an oil-hydraulic pump there is always a certain amount of misalignment between the pump drive shaft and the shaft on the power source. Even where universal drives are utilized there is still the danger of a thrust load. Result in both cases: Flexing is transmitted into the pump seal and eventually to the bearings supporting the gear—leakage around the shaft is a sure-fire bet to follow.

At Commercial, by using an outboard bearing to protect the seals and internal bearings, the common leakage nuisance is eliminated.

Seizing eliminated

Commercial oil-hydraulic pumps cannot seize because of heat induced by high speed or even inadequately piped systems. Variable end clearance and positive internal alignment make seizing practically impossible. Bearings evenly loaded throughout their length—no corner loading or spawling—are able to withstand much higher operating pressures. They stay in service longer too—regardless of pressures involved.

To take full advantage of tight internal tolerances Commercial designs, produces and grinds its own rotating gears—is able to hold extra close tolerances on tooth contours, outside diameters, and concentricity.

Over 5,000 different pump combinations—port locations and sizes—can be built from Commercial's standard line of oil-hydraulic pump components. A wide variety of drive shafts and mounting combinations are available to solve virtually any individual installation, piping and power application requirement.

ENGINEERING DATA FREE

For more information write to Dept. A-45, Commercial Shearing & Stamping Company, Youngstown 1, Ohio. Better yet, send for your copies of Commercial's free engineering reference bulletins. Just check the items below in which you are interested.

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- ☐ "Performance Rated Oil-Hydraulic Valves Catalog H-12"
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The flame test, above, dramatizes the effectiveness of Sun's new fire-resistant hydraulic fluid. The wick in the conventional fluid burns readily; the wick in Sun's new fluid just can't be lighted.

SUNSAFE, a water-in-oil emulsion, eliminates fire hazards . . . provides increased safety to personnel and equipment. At the same time, operators get the essential performance characteristics of a top-grade hydraulic oil—low rates of wear, long service life, and protection against rust and corrosion.

This combination of *quality* in engineering know-how, and *quality* in product, proves once again that *quality* in any sense is the best economy of all.

For 73 years Sunoco has meant quality right down the line. Today, this quality is found in more than 400 Sunoco industrial products. SUN OIL COMPANY, Phila. 3, Pa., Dept. I-14.

In Canada: Sun Oil Company Limited, Toronto and Montreal.

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NEW SOLENOID VALVES *by* Airmatic

These corrosion-proof valves have only one internal moving part and a completely protected solenoid coil. The coil is fully sealed from air, oil, gas and water . . . and will not overheat on continuous duty. Coils for continuous or intermittent duty, a-c or d-c, are interchangeable.

Life expectancy is many millions of cycles and by renewing the one-piece valve plunger, many millions more can be expected. The plunger can be replaced without disturbing rigid piping.

DISTRIBUTORSHIPS FOR THESE NEW VALVES ARE AVAILABLE

SPECIFICATIONS		
	TWO-WAY	THREE-WAY
CATALOG NO.	91011	91011
PRESSURE RANGE	1/16" ORIFICE: 0-500 PSI 3/16" ORIFICE: 0- 70 PSI	1/8" ORIFICE: 0-300 PSI 3/16" ORIFICE: 0-100 PSI
ORIFICES	1/16" THROUGH 3/16"	1/8" AND 3/16"
VOLTAGE	MOST A-C AND D-C	MOST A-C AND D-C
DUTY	CONTINUOUS	CONTINUOUS
POWER CONSUMPTION	10 - 20 WATTS	10 - 20 WATTS
HEAT RISE	WITHIN UL LIMITS	WITHIN UL LIMITS

AIRMATIC VALVE, Inc.

7313 Associate Avenue • Cleveland 9, Ohio

EVERYTHING UNDER CONTROL

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3-position weld cylinder has two pressures

• By W. S. RUDIN, *Sciaky Bros., Inc., Chicago, Ill.*

To spot weld aluminum to high commercial or military specifications, you need high electrodes force to hold the parts together, low force during actual welding, and high force again to compress the parts during cooling. Here's how air pressure changes forces in the electrode cylinder during a weld sequence.

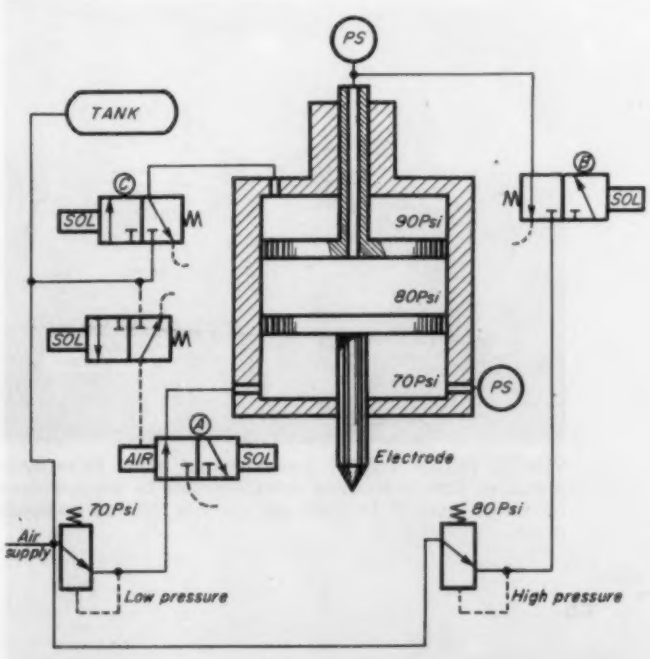
WHEN resistance welding mild or stainless steels, a constant electrode force is used. With aluminum, the forces must be varied for quality results. The aluminum welding sequence has four phases—squeeze, weld, hold, and off times. Pressure drops during welding, or current passing phase, to decrease the work piece conductivity and thereby increase the heat. During the hold time, compression force is again applied, so that internal molten metal, which has expanded, will solidify and form a weld nugget. Annealing current and recompression produce crack-free welds.

Pressure requirements are met by a pneumatic system using a 2-piston cylinder on a Sciaky SPT-2 welder. Unregulated plant air is let into the top chamber of the cylinder for all parts of the cycle except full retraction, when the top piston must rise to the top of the cylinder. Regulated air is admitted to the middle chamber through the upper piston rod, while air regulated to a lower pressure is let into the lower chamber. The small pressure differential on the piston results in low force on the electrode. The high force part of the cycle is caused by high pressure air in the middle chamber while the lower chamber is exhausted. Partial retraction is made when the lower chamber is pressurized, and the middle one exhausted. An adjustable lock-nut limits upper piston travel and the weld stroke.

Solenoid-operated valves are foot-switch controlled and timed for proper welding sequence. □□□

PNEUMATICALLY CONTROLLED welding machine. High, low or variable pressure sequencing is selected on the control panel. Two pressure regulators are mounted nearby.

ELECTRODE CYLINDER has two pistons. The bottom piston rod attaches to the weld electrode. The top piston divides the two upper pressure chambers. The electrode has three positions: fully extended, partially retracted, and fully retracted. Between welds, valve A opens to the bottom chamber while valve B exhausts the middle one and the electrode piston partially retracts. If necessary, an independent action permits valve C to exhaust the top chamber and the electrode to retract fully so that the work piece can be easily removed. Full extension is only during the weld time, when the two top chambers are pressurized.



Prefill valves sequence pump and

• By R. A. JACOBSON, *Chief Engineer, Kux Machine Co., Chicago, Ill.*

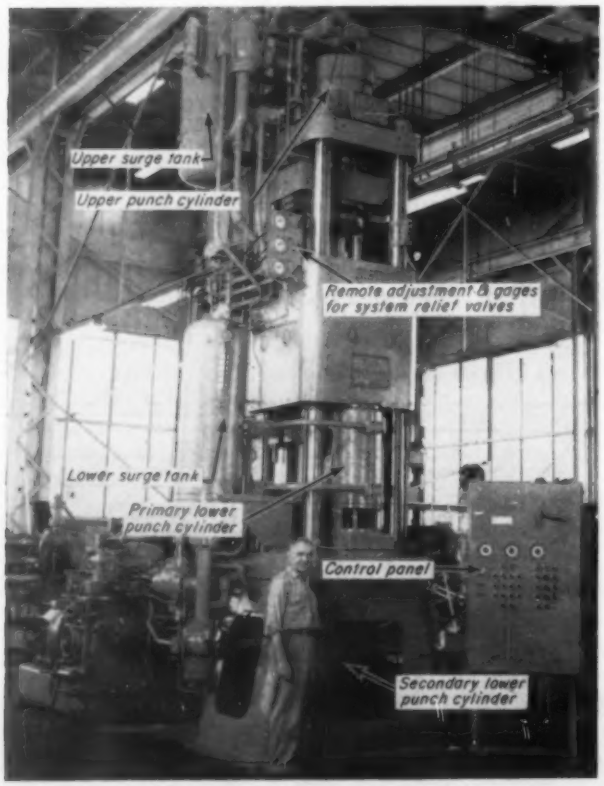
A HIGH speed powdered metal compacting press requires fast ram travel, high force, and quick reversal. One recently designed by Kux Machine, compacts 15-inch diameter parts, with a 10-inch powder fill, at a speed of 6 per minute. It has a force of 300 tons.

The press has one upper punch and two independent lower punches. The primary lower punch exerts 300 tons force, and the secondary punch, 150 tons. Compacting force required varies directly with the amount of powder between the upper and lower punches.

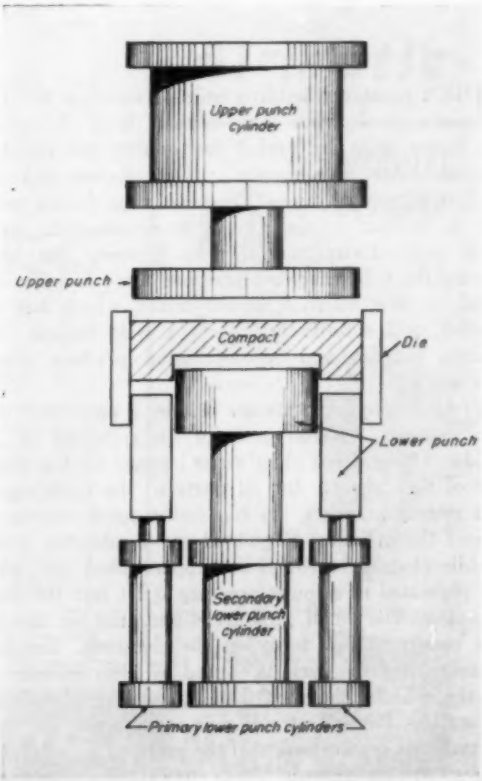
To eject a finished part, the primary and secondary lower punch cylinders must move in complete unison or the compact will break. To synchronize their motion, a flow control valve limits the quantity of oil to the secondary punch cylinder, by bleeding a portion of the oil back to the tank. This system is used rather than a more complex servo system because it is easier to maintain. Limit switches and timers control punch movement and compacting time.

Remote pilot relief valves, mounted on a panel near the operator, regulate main system relief valves. These pilot valves permit control of all circuit pressures from one point. They require only a ¼-inch vent line to the main relief valve. Any pressure from 0 to 3000 psi can be applied to any of the cylinder circuits.

Accumulator output combines with pump discharge to advance the ram fast. Standard prefill valves cut



VENTED RELIEF VALVES permit control of all three cylinder pressures from one central point. Pressure to any cylinder can be varied from 0 to 3000 psi on this 300-ton compacting press.



BOTH UPPER AND LOWER CYLINDERS extend to give a uniform density of the compact. Two lower punches are necessary to compact irregular shapes.

accumulator flow

the non-separator accumulators in and out of the circuit. The accumulators augment pump flow to extend the cylinders, and are refilled and pressurized by returning oil to them when the cylinders retract.

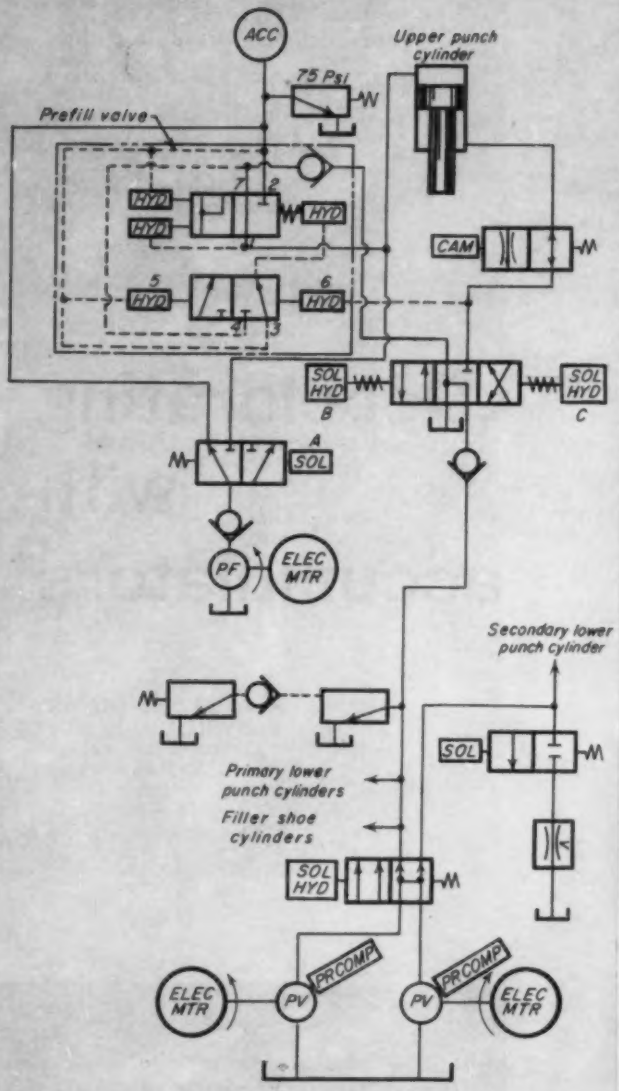
• **Power Unit**—Two, variable-displacement, pressure compensated pumps supply oil to the circuit. A third, low-volume, high-pressure, fixed displacement pump supplies oil to the upper cylinder. Output from this pump prevents pressure drop in the upper circuit while the lower cylinders are extending. When the upper cylinder is retracted, discharge from this pump returns to the tank through a low pressure relief valve.

Output from the two variable-volume pumps combine to extend the upper and lower punch cylinders. When compacting is completed, the upper punch cylinder retracts. To eject the compact, the primary and secondary lower punch cylinders must move together. During this phase of the cycle, the 2-position 4-way solenoid valve is energized and the output from each pump enters a separate circuit. One delivers to the primary lower punch cylinders and the other to the secondary lower punch cylinders. The secondary cylinder has a smaller area than the combined area of the primary cylinders. To synchronize their movement, flow of oil to the secondary cylinders is regulated by an adjustable flow control valve which returns excess oil to the reservoir. By adjusting this valve, the two lower cylinders can be made to move at the same speed.

• **Prefill circuit**—To extend the press cylinder silenoid *C* is energized directing pump pressure to port 7 of the prefill valve. The two prefill valve spools shift. Both pump and accumulator output combine to extend the cylinder. When it meets the work, pressure builds up at port 4 and shifts the main valve spool. Accumulator flow is shut off and pump discharge completes the stroke.

Solenoid *A* is energized and the output from the low-volume, high-pressure pump *PF* is directed to the upper punch cylinder.

When compacting is complete solenoid *B* is energized directing pump output to the rod end of the upper punch cylinder. Pressure at pilot 6 shifts the secondary spool of the prefill valve. The check valve in the prefill valve blocks flow from the blind end of the cylinder. Pressure builds up and shifts the main spool directing oil back to the accumulator. Solenoid *A* deenergizes and output from the low-volume pump returns to the reservoir through the accumulator relief valve. □□□

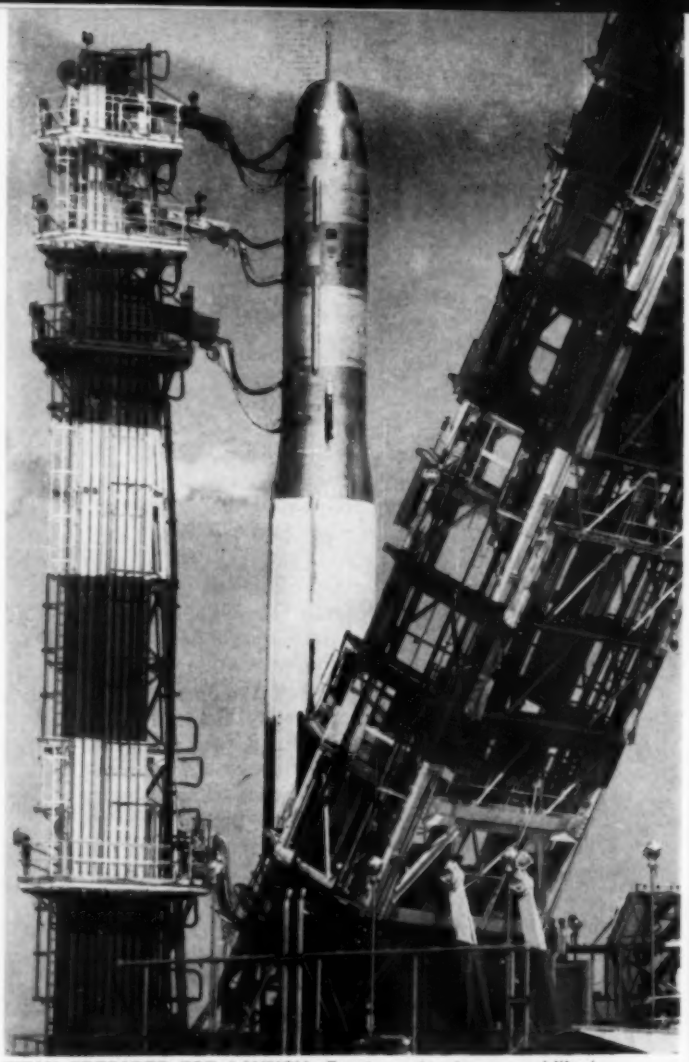


NON-SEPARATOR ACCUMULATOR, precharged with air at 75 psi, stores oil for fast cylinder advance. A similar accumulator is used in the lower punch circuit. A high pressure, low-volume pump allows the upper punch circuit to maintain its high pressure while cylinders in the lower circuit are extending.

Titan's release frames use accumulators as a cushion to snub fast actuation. A hydraulic power supply feeds all GSE functions for the missile.

Decelerating with accumulators

• By ALBERT C. NOTARY and WILLARD L. HUEY
Martin Company
Cocoa, Florida Division.



TITAN PREPARED FOR LAUNCH. Erector retracts as umbilical tower continues to feed the missile until liftoff.

HOLDING Titan in place prior to liftoff, are four large A-frames. Each frame weighs about 5000 pounds and is retracted by a cylinder of 6-inch bore and 32½-inch stroke. Retraction time is 5 degrees in 0.60 second and 15 degrees in one second from the time of liftoff.

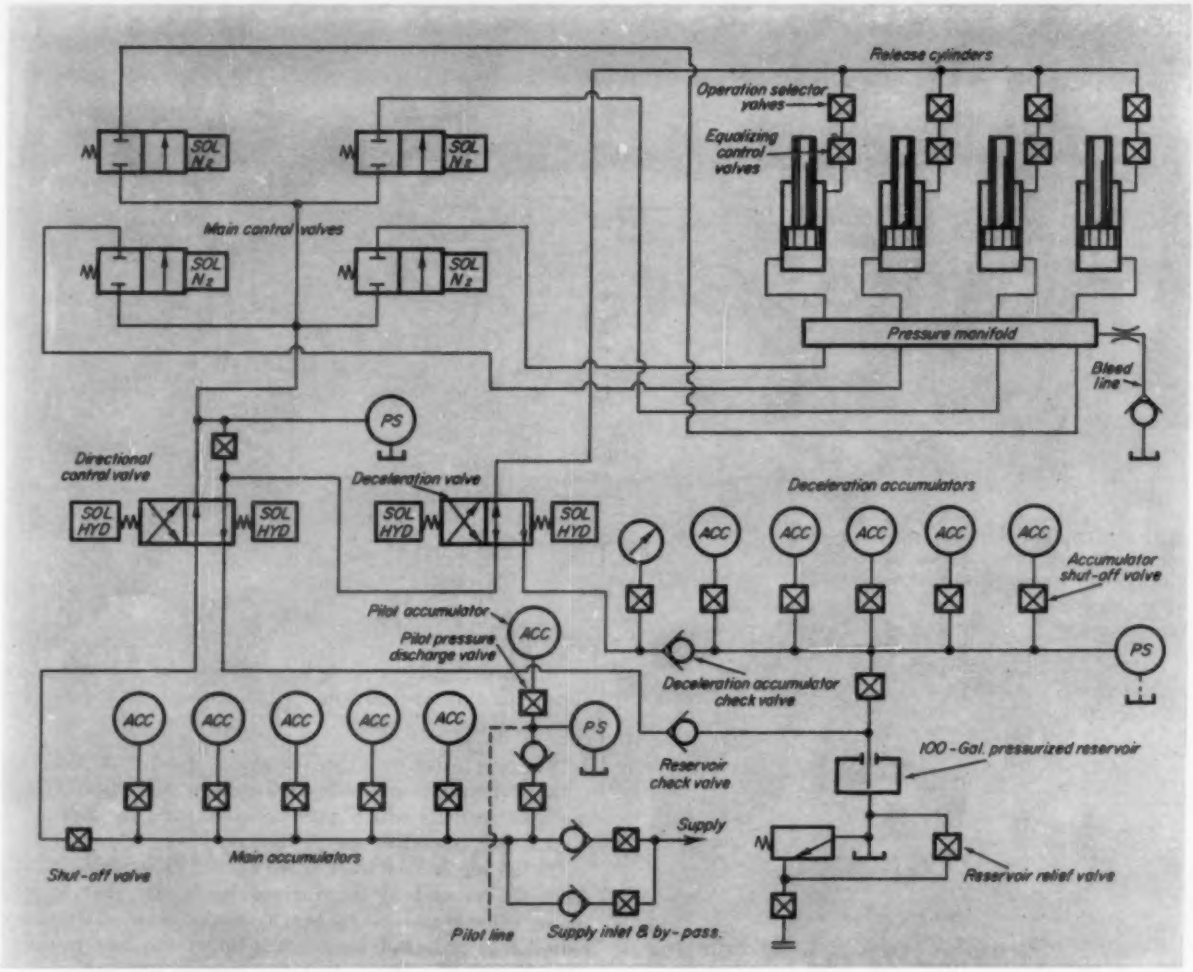
A valve bank contains equalizing control valves for the first 15 degrees of fast retraction, selector valves for slow retraction of individual A-frames, and the main control valves for fast actuation during launching.

This is a typical retraction-deceleration cycle when the missile is launched:

The oil-operated directional valve is shifted to pressurize the main control valves, which are closed. The 5 main and the pilot accumulators, nitrogen precharged to 775 psi, receive 1500 psi pressure from the power supply unit. After filling, the supply source is shut off and only make-up oil is permitted to enter through a bypass valve. At liftoff, switches signal both main control valves and the deceleration valve. Main valves, operated by 150 psi nitrogen, open in 0.07 second. The oil-operated deceleration valve takes 0.80 to shift. During this time interval, return fluid from the rod end of the cylinders is ported to the 100-gallon pressurized reservoir. When the deceleration valve is shifted, returning fluid is channelled to the five deceleration accumulators, which are nitrogen pre-charged to 950 psi. These accumulators give a slow, even snubbing and stop to the A-frames, short of their full travel of 37½ degrees. A check valve prevents rebound or reverse creeping at the end of the cycle.

A pressure manifold between the main control valves and the cylinders is a safety feature in case one of the control valves fails. A bleed line with a 0.061 diameter fixed orifice is connected to the manifold to bleed off control valve leakage.

• **Ground support power system**—Power source

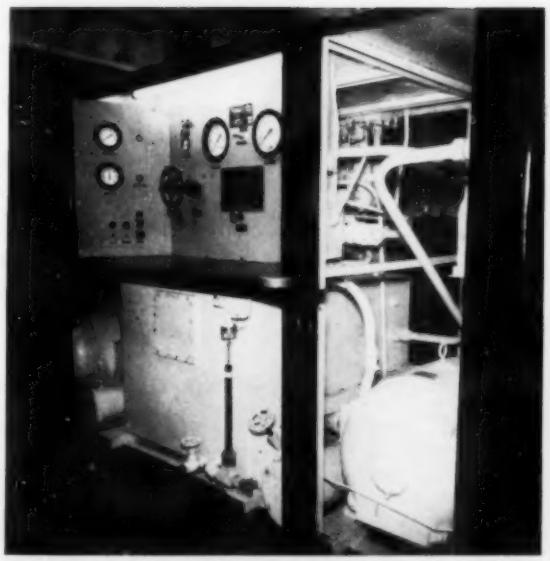


MISSILE RELEASE circuit shows the accumulator-deceleration valve arrangement for high speed launch release.

for all ground support equipment, this system uses two constant displacement, vane-type pumps totalling 95 gpm output at 1500 psi. Valves and controls are manually operated. In addition to operating the missile release circuit, it powers the following systems:

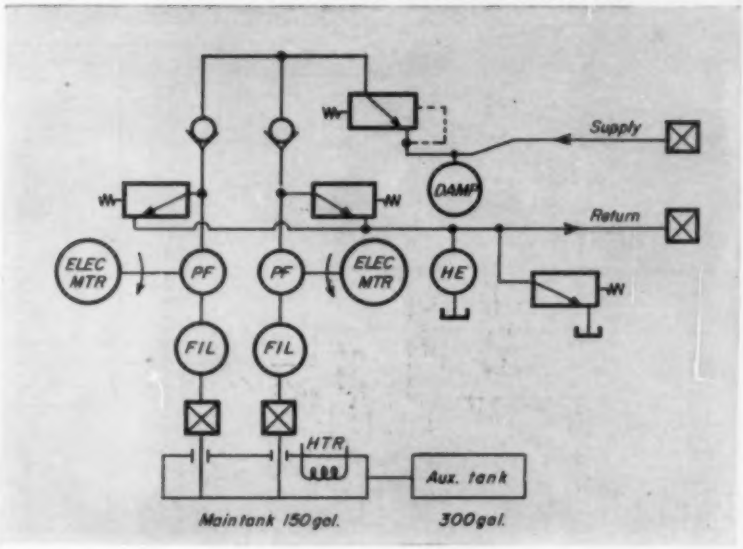
• **Erection**—Although an electric motor and winch raises and lowers the erector, two hydraulic assists are required: one for snubbing during the raising, and one for the tilt-back at the start of the lowering.

At the start of the raising cycle when the erector is about 3 degrees from its balance point, four main and two auxiliary cylinders are extended to receive and snub a movable cable block. A pair of link arms connect the block to the erector. After contacting the hydraulic cylinders, the winch continues to raise the block, forcing fluid out of the cylinders through relief valves set at 1575 psi. Fluid then returns to the tank through a bypass valve. As the erector passes its balance point, the bypass valve is closed by a cam-



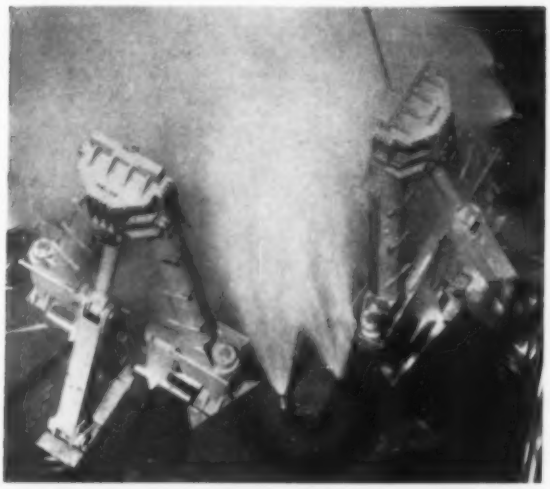
CONTROLS AND INSTRUMENTATION for the ground support power system, mounted on equipment frame.

DECELERATING WITH ACCUMULATORS



TWIN PUMPS pressurize the ground support power system. Large reservoirs are for servicing the long loops in the circuit.

CLAMPING CYLINDERS on the missile launching pad. These are actuated by the missile release loop in the ground support system.



operated control valve. The return fluid is metered by a flow control valve set at 35½ gpm. The winch brake does the final snubbing with the aid of the two auxiliary cylinders. When raising is completed, hydraulically operated yokes lock the erector legs into place.

To lower the erector, the hydraulic leg locks are removed, and 1500 psi fluid is applied to the head end of the two auxiliary cylinders. This force tilts the erector past its vertical balance point where the winch completes the fall control.

• **Erector platform positioning**—Each of the seven work platform levels in the erector consists of movable sections which may be positioned by individual selector valves and cylinders.

On the top erector level, a jib hoist lifts equipment from the ground to the various levels. Its electric motor drive is assisted by two hydraulic sources. One cylinder extends and retracts the boom and fine positioning is done by a movable sheave attached to another hydraulic cylinder. A manual selector valve with needle valves installed in the extend and retract lines controls the cylinder which moves the sheave.

• **Umbilical boom retracting**—Four hydraulically retractable booms connect umbilical cables to the missile. This assembly, duplicated on each level, consists of a shutoff valve, check valves, needle valve, accumulator, and two selector valves.

During normal check, each assembly used one selector valve for slow extension and retraction. During actual launch, however, both selector valves are used for fast retraction. To prevent creeping of the boom, a combination check and needle valve bleeds selector valve leakage into the return line. □□□

HOW THE TITAN IS GROUND CHECKED BEFORE LAUNCH

An auxiliary hydraulic power system is used to check out the engine gimballing and vernier rocket positioning portions of the flight control system before a countdown, and to verify that the missile hydraulic system is ready for flight. Two separate supply sub-systems, one for each missile system, are incorporated into the unit.

The Titan and the auxiliary power system operate as a single closed loop just prior to actual launch, with fluid supplied by the missile reservoir. A remote control console constantly monitors all output and return pressures, fluid temperatures, rates of flow, reservoir levels, and thrust chamber and rocket positioning.

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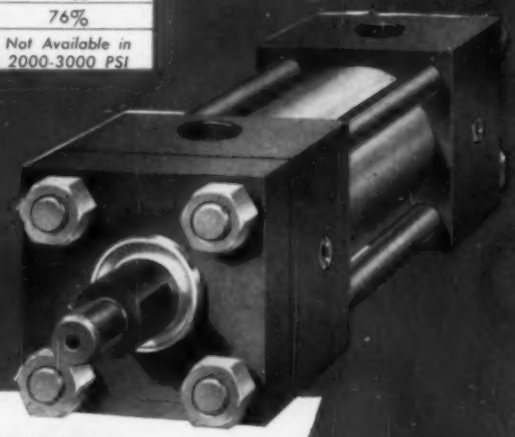
2½	1000	1500	28%
3¼	1500	2500	32%
4	1000	1500	35%
5	800	1200	37%
6	800	1200	43%
8	500	800	50%
10	500	800	71%
12	500	800	76%
14	500	800	*Not Available in 2000-3000 PSI*



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MILLER Uses Resin-Impregnated Leather Piston Cup Seals because they are compatible with petroleum base fluids and some fire-resistant types. Teflon cups available at small extra cost.

2. *Nicked or scored piston rods cause seal failure*

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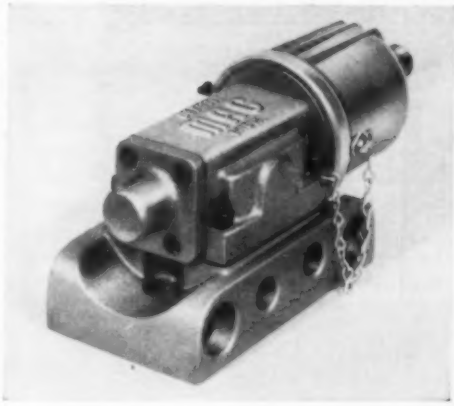
COUNTERBALANCE CYLINDERS ... BOOSTERS

New Solenoid Air Valves Need No Accessories

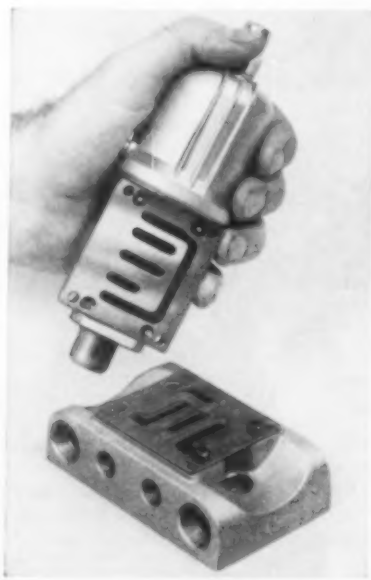
Now available for the first time are solenoid operated air valves complete with all accessories at 'bare valve' prices. Available in ¼, ⅜, and ¾ in. port sizes, they come in single- and double-solenoid types in 3-way, 4-way and 4-way 5-port models.

Features include: solenoids interchangeable on all models of a given size; pre-wired plug-in type bases, eliminating customary wiring; standardization of bodies and bases for interchangeability; unusual compactness; elimination of troublesome fasteners in solenoid assembly (which floats in rubber).

All valves are equipped with screwdriver or ball type manual solenoid operators with lock-in and lock-out feature.



Manifold type bases with common inlet exhaust, and conduit, available on ¼ in. models. For complete information, ask for MAC catalog #60.

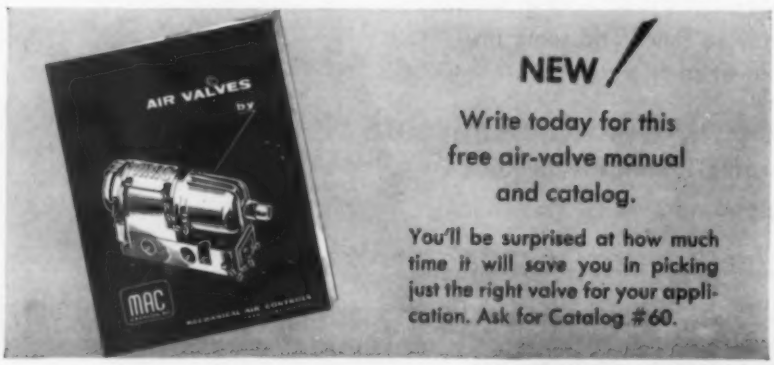


Plug-in Connectors Now Standard on All MAC Solenoid Valves

Pre-wired bases, into which you simply plug in the valve body, are now standard on all MAC solenoid valves—both direct-solenoid and solenoid-air types. Bases are identical for single- and double-solenoid valves of a given size.

The same principle is also applied to the "add-a-unit" manifold type bases available for all MAC solenoid valves. With these, from 2 to 10 valves can be coupled with common inlet, exhaust and conduit. Individual valves can also be isolated or pressure fed in from each end.

With plug-in leads provided on all solenoids, wiring of valves has been reduced to the utmost in simplicity.



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advances in
PNEUMATICS

MAC

evolution of valve seals...

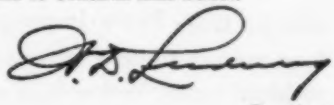
While metal-to-metal seals work well in hydraulic valves, where inherent leakage is accepted, positive leakproof sealing is mandatory in air valves. Flexible seals are today accepted as vital and they must be so designed that sealing efficiency increases with pressure. The seal should be self-cleaning so that foreign matter won't cause leakage.

At one time O-rings were thought to be the answer. O-rings are excellent for static sealing or where travel is short. O-rings are unsatisfactory, however, when used as valve seals crossing an orifice due to the shearing action.

Developing the best design and compound for air-valve seals was a long and tedious job, since elasticity, durometer hardness, compression set, and co-efficient of friction are also important factors.

Experience to date has proven that the best valve seal is a special Buna-N base self-lubricating oil-resistant compound—bonded to the metal to keep it from distorting.

This is the type of seal used in MAC valves. We believe it represents an ideal combination. At least, their amazingly long life in MAC valves seems to confirm that belief.



President

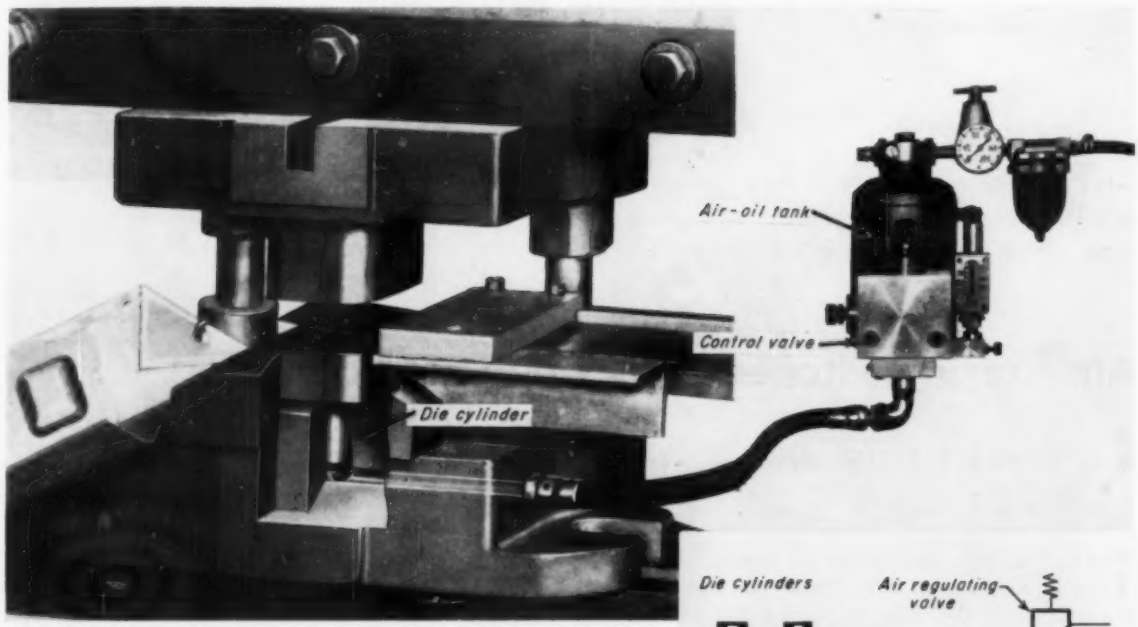
MAC

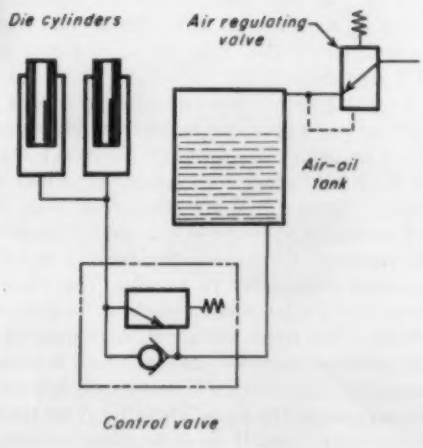
MECHANICAL AIR CONTROLS, INC.
18030 Capital, Oak Park • Detroit 37, Michigan

Press ram powers die cylinders

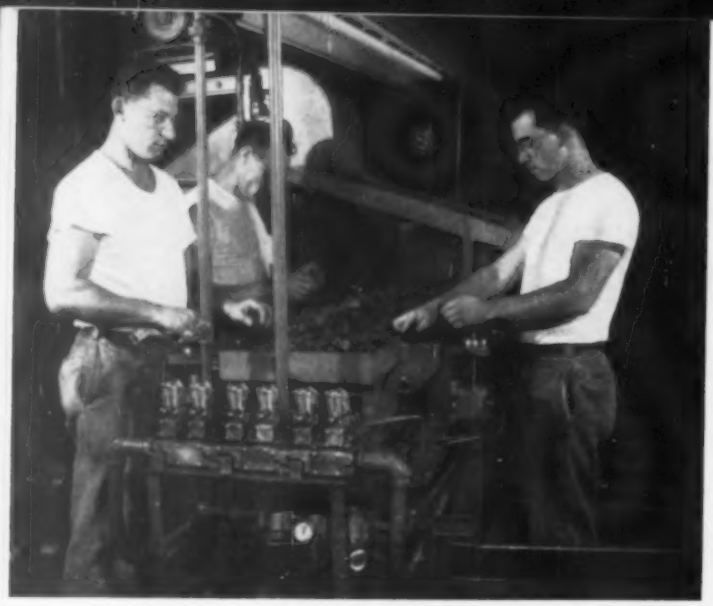
HERE'S a special air-oil intensifier that replaces die springs in blanking, piercing, extruding, and trimming operations. It supplies constant or intermittent pressures to 5000 psi to the die cylinders.

• **Operation**—The unit has a closed hydraulic system. Pistons are installed in place of springs in the die cavities. Oil is trapped between the pistons and a special control valve. As the press ram extends and meets the work, the die pistons retract. Pressure builds up behind them to the setting of the relief valve. This pressure holds until the press ram retracts. Air pressure in the air-oil tank then forces oil through the check valve and extends the die cylinders. Return pressure is governed by the setting of the air pressure regulator. □□□

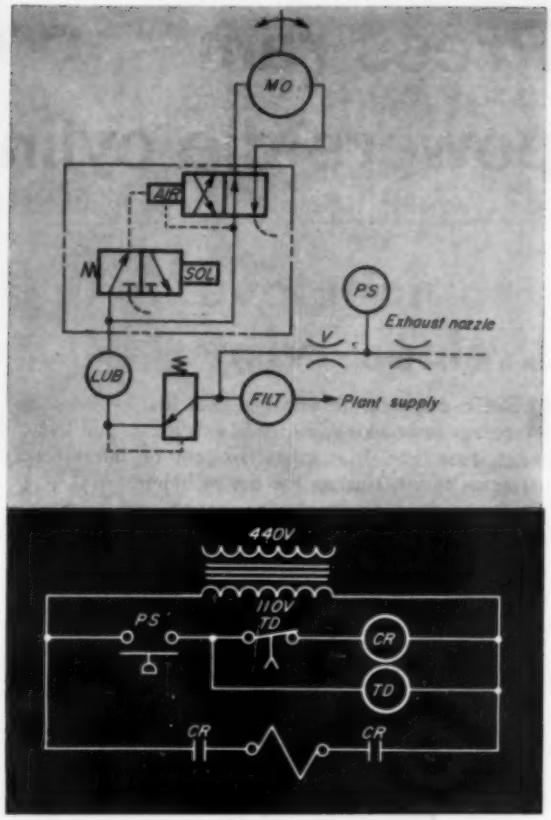




CONTROL VALVE can be mounted at the die or at the air-oil tank. Pressure on the die cylinders is varied by adjusting the spring on the relief valve. When the press ram lifts, air pressure (50 to 150 psi), in the air-oil tank forces oil through the check valve to extend the die cylinders.



SIX AIR VALVES ARE MANIFOLDED to make a compact installation for controlling six grooving set-ups. Valves direct air to rotary actuators which drive fly cutters.



PRESSURE SWITCH ACTUATES when exhaust nozzle is blocked by workpiece. Pressure switch then closes and actuates relay and time delay relay, thus energizing solenoid valve for timed period.

Here's a simple way to sequence an air system. The cycle starts when the workpiece closes an air exhaust nozzle, raising pressure to actuate a pressure switch.

Air nozzle switches rotary actuator circuit

• By HENRY E. BORATEN, *Hydraulic Specialist, Ford Motor Co., Lima, Ohio*

TO CUT an oil groove on the ID bearing face of an engine rocker arm, Ford designers came up with a simple set-up that puts out 4220 pieces an hour at 80% efficiency.

A cutting tool is fixed at 90 degrees in a shaft like a fly-cutter. The shaft is rotated 280 degrees by a rotary actuator. The operator places a rocker arm on the shaft and rotates it against the nozzle of an air orifice. This cuts off air exhausting from the nozzle, and raises the pressure to actuate the pressure switch. The pressure switch contacts close and energize a relay and time delay relay in parallel. The relay energizes the solenoid valve which directs air to drive the rotary actuator. The timer times out, de-energizing the relay, but remains energized until pressure is released. This causes the tool to return automatically before the operator can remove the piece. This eliminates the possibility of a spiral groove. It also sets up an anti-repeat circuit until the grooving operation has been initiated again.

A lip on top of the air-jet, positive stop assures proper seating of the piece, so the groove is cut in the center of the rocker arm, in line with the oil hole. These features maintain quality of this operation.

When the circuit was first designed, the pressure switch circuit was connected to the downstream side of the pressure regulator. However, air pressure fluctuations caused by the rotary actuator affected operation of the pressure switch. The circuit was changed to operate directly from plant air supply which maintains a constant supply pressure. The variable orifice preceding the pressure switch is adjusted to provide a flow area equivalent to the exhaust nozzle. The restriction of air leaving the nozzle and escaping through the annular passageway formed between the nozzle and workpiece increases the air pressure between the two orifices and actuates the pressure switch. □□□

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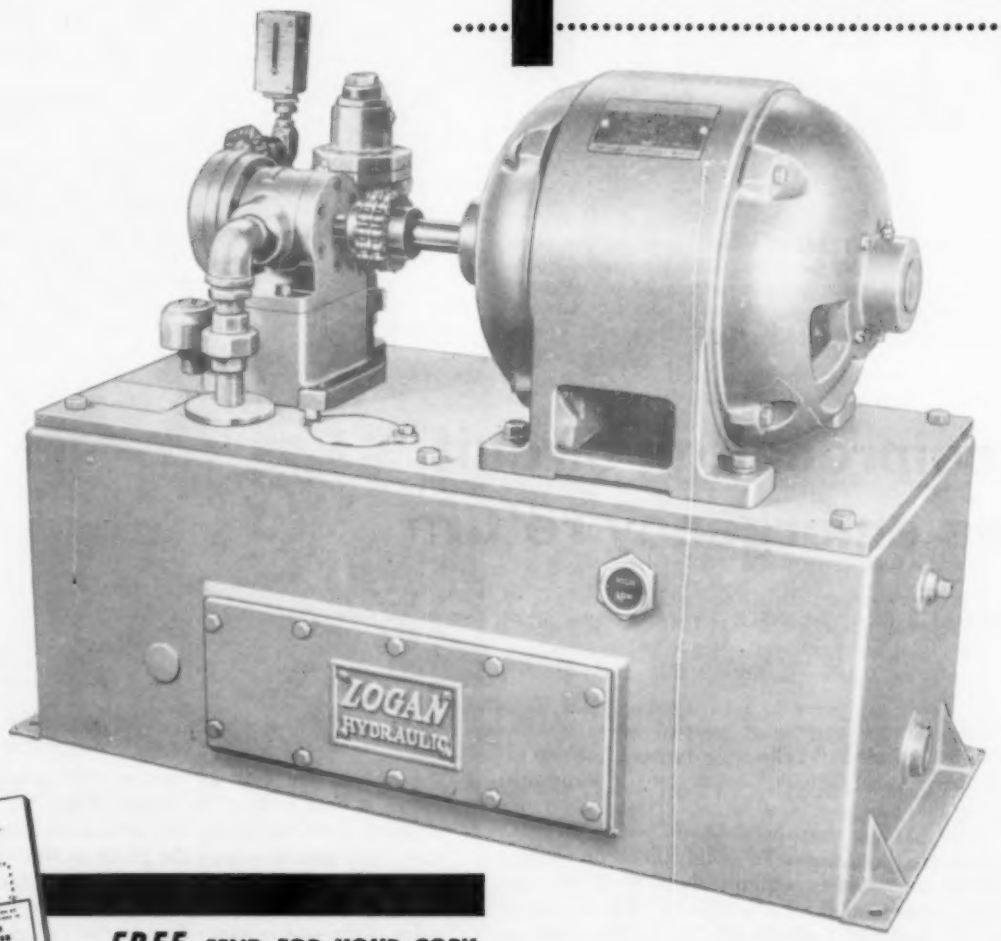

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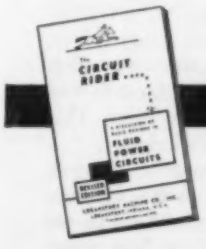

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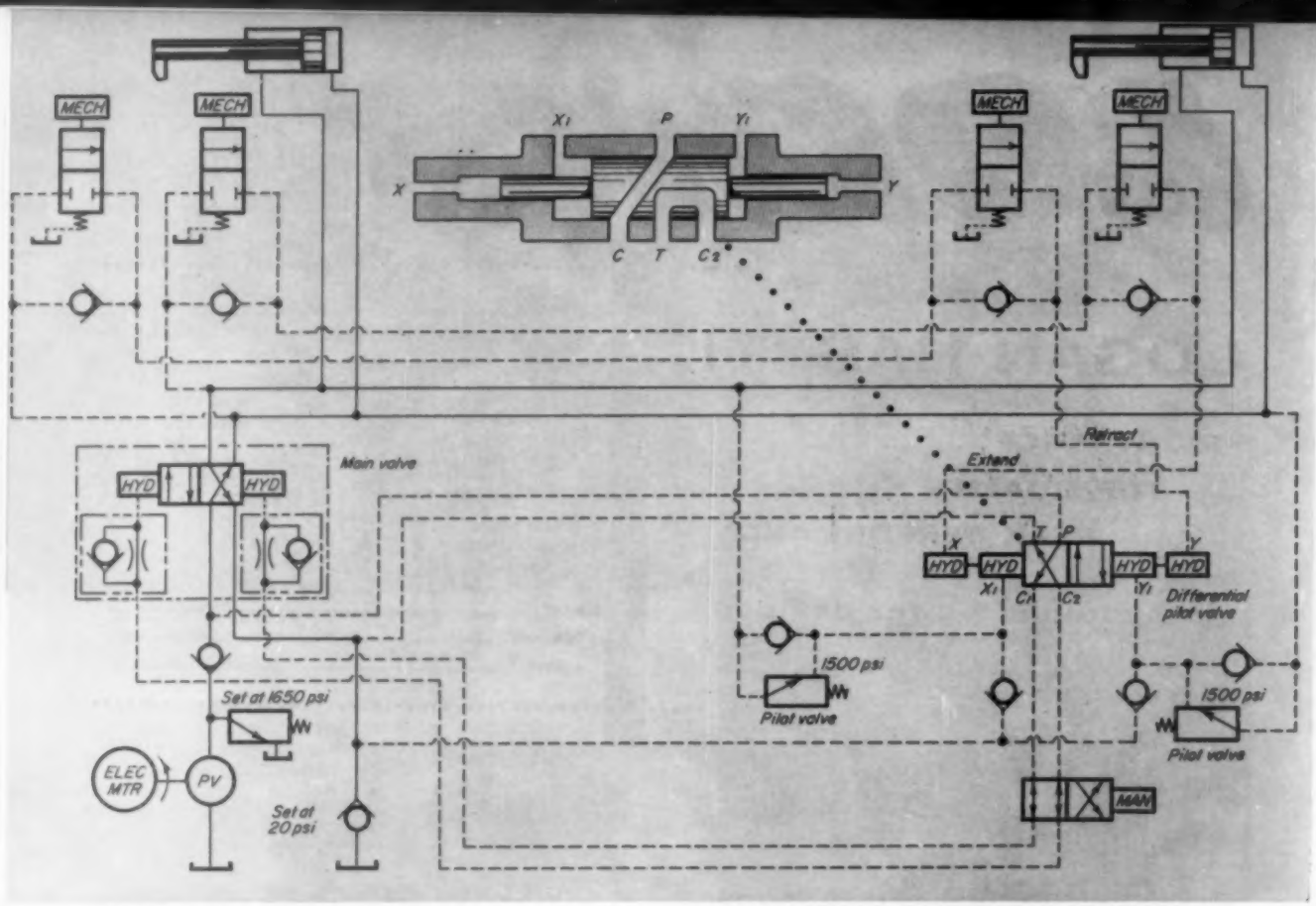


DIFFERENTIAL PILOT VALVE directs fluid to the pilot actuators on the main 4-way valve. During normal operation, the system check valve maintains 20 psi at ports X_1 and Y_1. Pump discharge pressure at port **X** or **Y** holds the valve spool right or left. If either cylinder meets resistance during its stroke, pressure builds up to the setting of the pilot relief valve. This pressure enters port X_1 or Y_1 and drives the valve spool right or left, reversing pressure to the pilots on the main 4-way valve. The valve shifts and the cylinders reverse.

Reciprocating circuit has emergency return

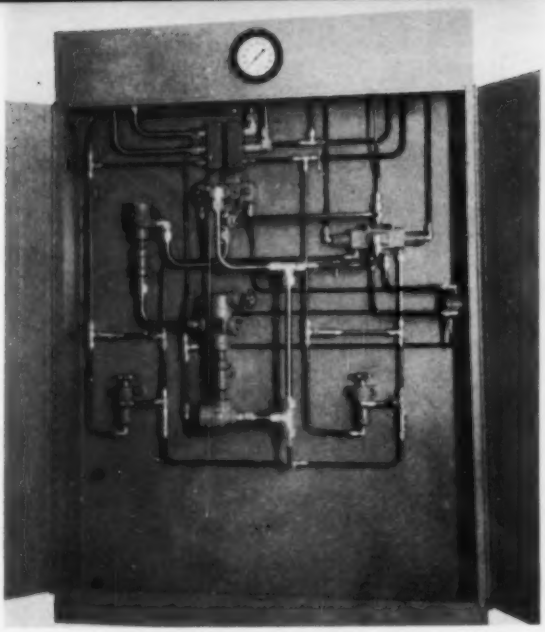
• By HAROLD A. YARNELL, *Design Engineer, Surface Combustion Corp., Toledo, Ohio*

IN THE thermal process of mineral ore concentration a vertical-shaft pelletizing furnace heats hardened, balled, finely divided solids into a form suitable for charging to a blast furnace. Near the bottom are seven parallel, horizontal shafts which stabilize flow through the furnace. They also break up clusters of pellets so that they will discharge from the converging furnace outlet. A hydrau'ic system rotates the shafts back and forth through 45 degrees rotation. To prevent stalling under high torque, the shafts reverse their rotation when the torque reaches a set limit. Crank arms connected to hydraulic cylinders rotate the shafts.

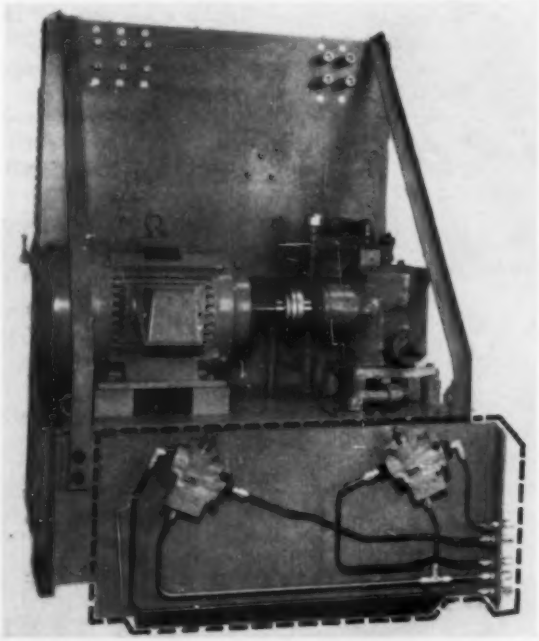
Pump output is manually set from 0 to 12 gpm depending on the cylinder speed needed. A relief valve set at 1650 psi protects the system against overpressure.

Cams on the cylinder piston rods actuate 2-way valves at both ends of the stroke. When the cylinders complete their full stroke and open both 2-way valves, flow is directed to one of the pilots on the 4-way pilot valve. The pilot valve shifts, and admits fluid to one of the pilot actuators on the main 4-way valve. This valve shifts and reverses flow to the cylinders.

The cylinders operate at approximately 300 psi. If either cylinder fails to complete its stroke, pressure builds up. At 1500 psi a small quantity of fluid passes through one of the pilot relief valves. This fluid enters the pilot chamber on the 4-way differential pilot valve and shifts the spool. Pressure is then directed to one



HYDRAULIC VALVES and piping are completely enclosed in a metal cabinet. The cabinet protects the components from furnace heat and harmful dust created in the stone crushing process. Flow is connected through couplings welded in back of the panel. The pump and reservoir are in back of the cabinet.



REAR VIEW OF VALVE CABINET showing the cylinder outlets (top right) and the pilot 2-way valve connections (top left). Pump and motor are mounted on a 60-gal reservoir. Cam-operated, pilot 2-way valves with pressure and drain piping are shown at bottom.

of the actuators on the main 4-way valve. This valve also shifts, reversing flow to the cylinders.

A 2-position, manual, 4-way valve is piped into the pilot circuit to reverse flow to the pilot actuators on the main 4-way valve. By shifting this valve, the cylinders can be reversed at any point in their stroke. □□□

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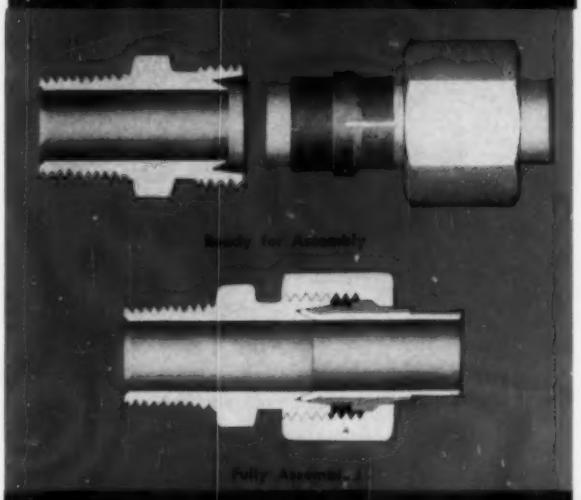

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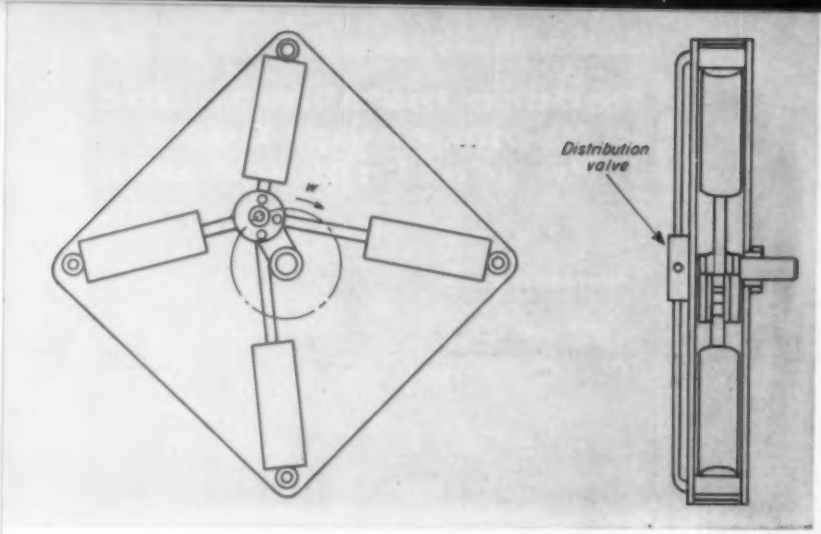


High torque

• By RUSSELL W. HENKE,

FIG. 1. RADIAL CRANK arrangement of motor designed for high torque, low speed mobile equipment applications.

The need for a high torque motor running at low speeds brought this novel design. Avoiding mechanical speed reduction, saved cost and space.

CONVENTIONAL, hydraulic motors must usually be geared down to develop high torque. Road machinery, construction and agricultural equipment, and lift devices all need low speeds with high loading characteristics. Speed reducers can cut the motor speeds to the desired 50 to 100 rpm, but they add cost and bulk to the system.

The motor developed to give the required high torque, low speed operation is a radial 4-cylinder, reciprocating piston configuration. The head end of each cylinder is pivoted about a fixed point, so each cylinder is free to swivel as the crank rotates, Figure 1. A special rotary valve is designed into one end of the crankshaft to distribute pressure and return fluid in smooth sequence, insuring continuous shaft rotation, Figure 2.

In this motor, torque output is a function of cylinder bore, crank throw, and operating pressure. Since the first two are constant for a given motor, developed torque is a function of pressure.

In a typical application as a road machine drive the motor delivers about 2,500 lb-ft of torque at 1,000 psi, 5,000 lb-ft at 2000 psi, and 7,500 lb-ft at 3000 psi. Dimensions are 24 x 24 x 6 in.

A fluid delivery of 94 gpm would give 12 mph road speed. □□□

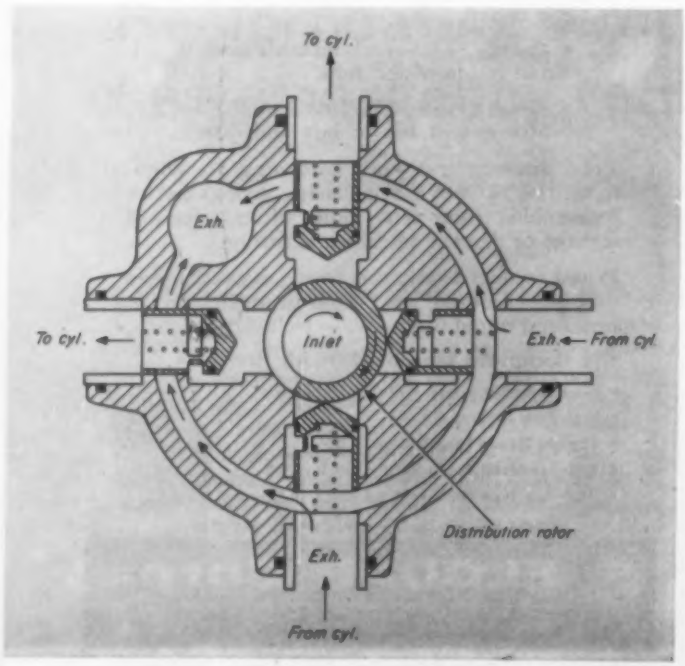
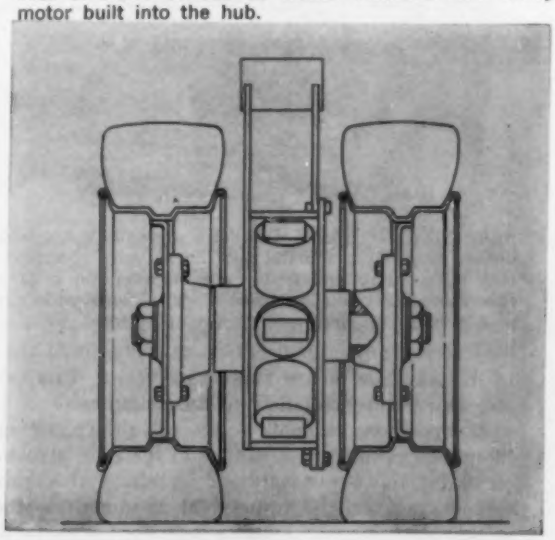


FIG. 2. ROTARY DISTRIBUTING VALVE in section. Spring loaded poppets distribute fluid as the inlet rotor opens supply to the proper port.

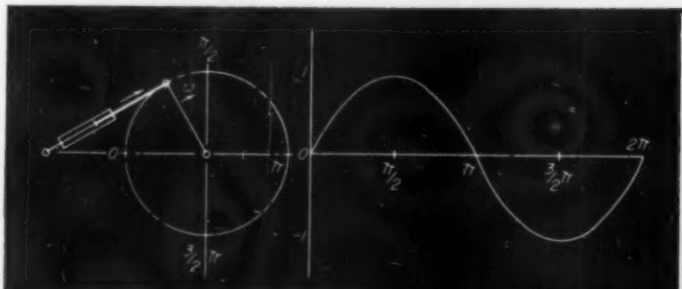
FIG. 3. DUAL WHEEL OF ROAD VEHICLE with rotary motor built into the hub.



motor has radial crank design

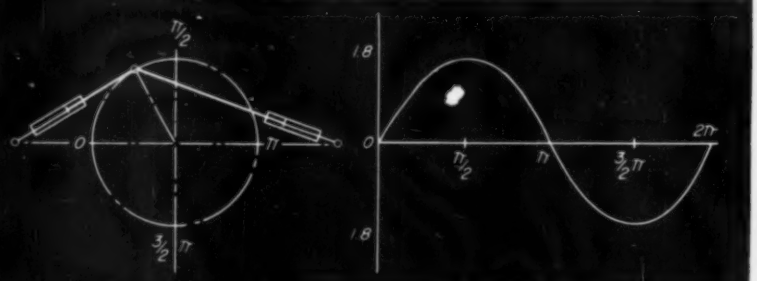
Russ Henke Associates, Elm Grove, Wis.

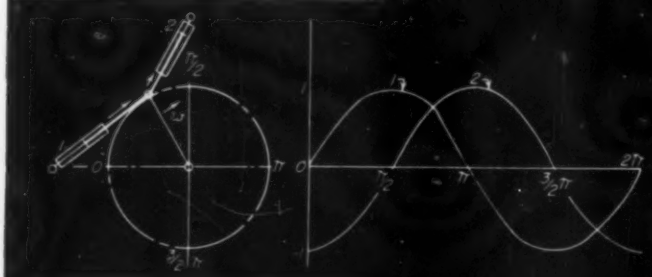
WHY FOUR CYLINDERS?



This torque curve is for a single, double acting cylinder. Torque during extension is greater than during retraction. The sinusoidal pattern is unsatisfactory for a machine drive, because torque drops to zero twice during the cycle. The motor would stall the moment that the available torque equaled the required torque.

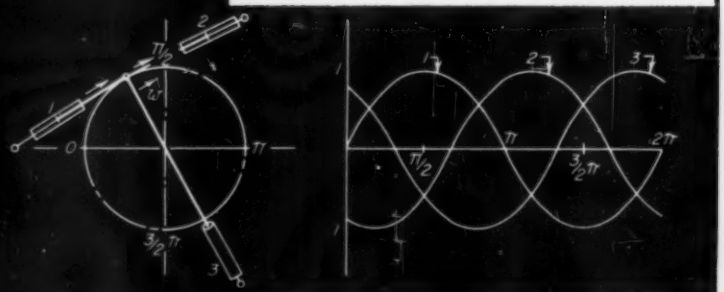
Two opposed cylinders give this curve. Still sinusoidal, its amplitude is now a function of the sum of the piston areas. Single-acting cylinders can be used here, but the torque pattern is still as unsatisfactory as in A.

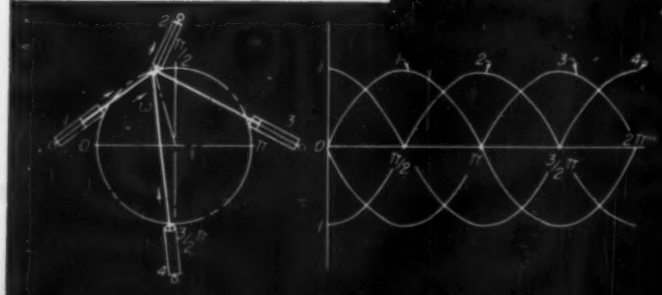




Placing the two cylinders at right angles to each other eliminates the dead spots at the π and 2 π points. One curve leads the other by 90 degrees, preventing the torque from going to zero. The combined torque curve, a series of peaks and valleys, would give a sinusoidal gallop effect.

The next step is 3-cylinders spaced 120 degrees apart. Extreme variations in torque are damped to a great extent, giving smoother operation.





Addition of the fourth cylinder results in an even smoother pattern and permits economical design and construction.

• By ELMER F. HEISER, *Precision Products, Inc., Cleveland, Ohio*

Synchronizing rotary actuators

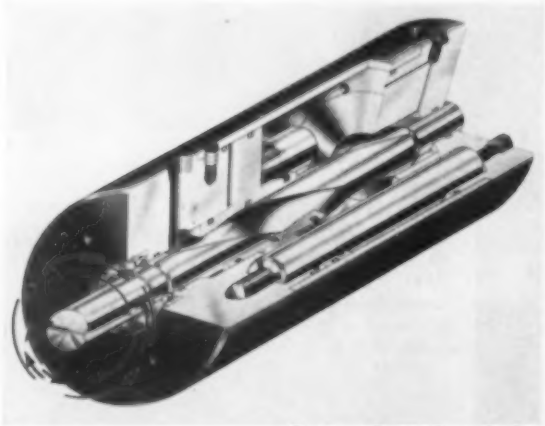
PROBLEM—*Synchronize two hydraulic rotary actuators which cannot be connected together mechanically. They must move together with reasonable accuracy, through a 90-degree, low torque index.*

ANSWER—Each torque actuator drives an indexing mechanism in one direction only, and synchronization is required only on the driving stroke. As the actuators reset for another index stroke, it is not necessary to keep them in any definite relation to each other.

The rotary actuators selected for this application have a piston which rotates a helical shaft as the piston advances under pressure. The piston is keyed to two rods to prevent it from rotating. Assuming negligible leakage through these torque elements at the low pressure required for the operation, we developed the control circuit shown.

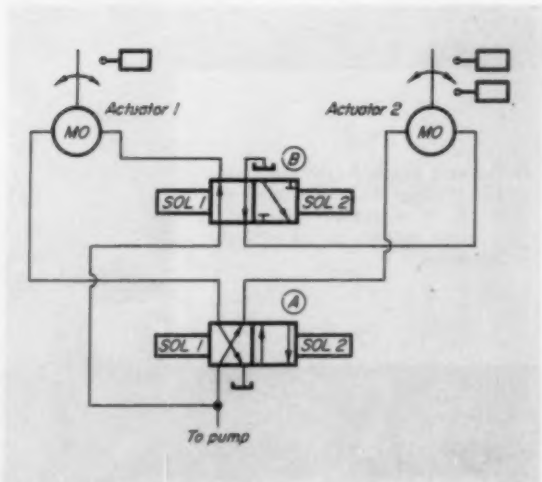
Valve *A* is a conventional 4-way, double solenoid, 2-position valve. Valve *B* has modified porting as indicated. In the normal or reset position, valves *A* and *B* have been shifted by momentarily energizing solenoid 1 of each valve. With the valves in this position, actuator 1 is returned by pressure oil through valve *B*. Drain from the opposite end of this actuator returns through valve *A*. Actuator 2 is returned by oil flow through valve *A*. Drain from its opposite end returns through valve *B*.

For a synchronized index stroke, solenoid 2 on each valve is momentarily energized. Flow from valve *A* connects to the driving end of actuator 1 which discharges oil to the driving end of actuator 2. Discharge from actuator 2 connects to tank through valve *A*. To insure that both actuators are fully returned before an index stroke can start, two limit switches are installed at the actuators. A third limit switch is installed at the 90-degree point on actuator 2, to insure a full stroke by both units. □□□

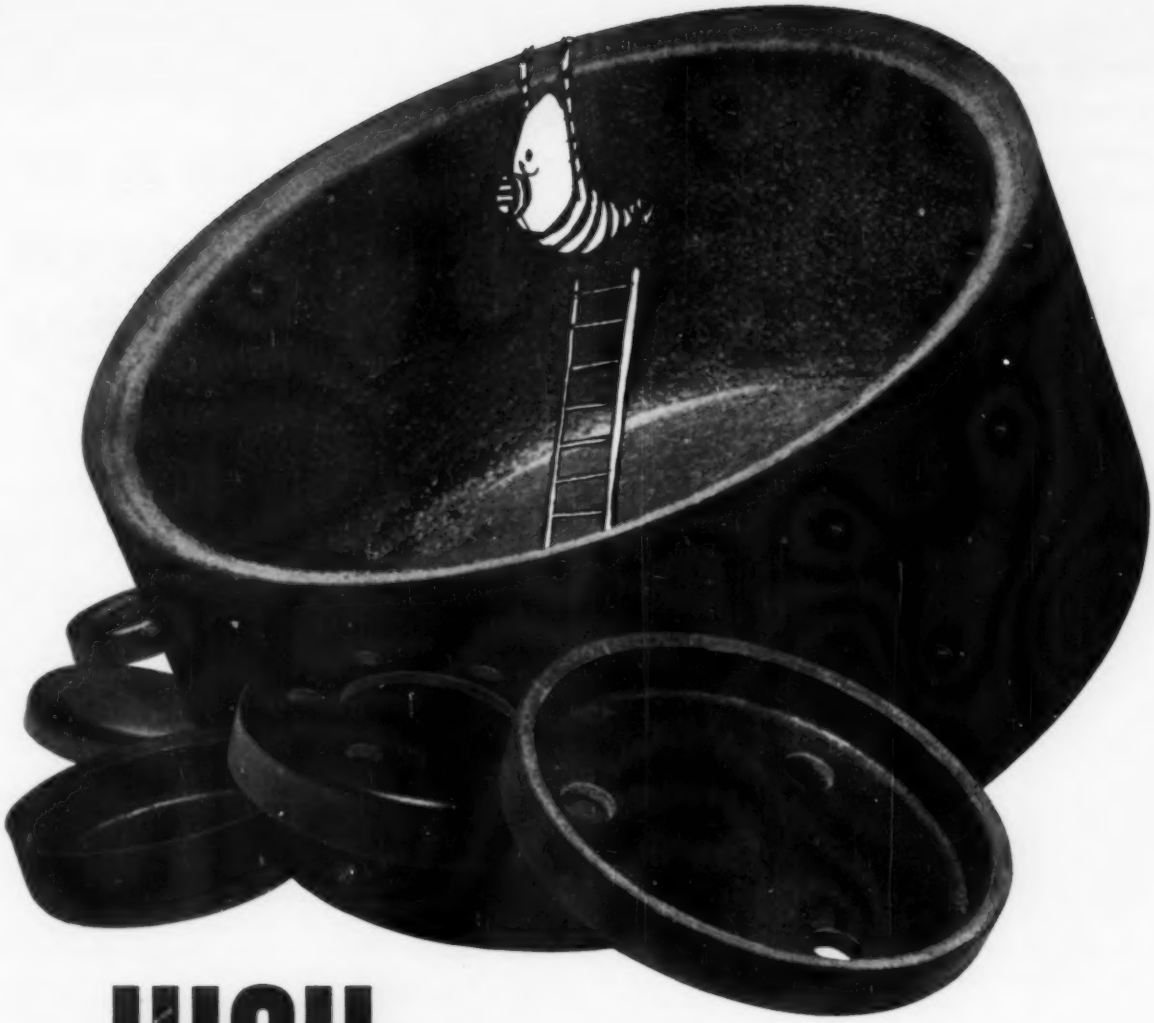


Courtesy Carter Controls, Inc.

ROTARY ACTUATOR has helical shaft which permits locking at any point in rotation. Torque output ranges to 15,000 in-lb depending on input pressure and bore size.



VALVES A AND B connect rotary actuators in series when solenoid 2 of each valve is actuated. Limit switches insure that both actuators complete full stroke and are fully returned before re-cycling.



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Here's a design idea that can be adapted to many applications. Fitting air cylinders to existing manual levers permits remote control and eliminates a dirty, backbreaking job of operating cement hoppers.

Air-controlled hoppers speed loading

• By LAWRENCE GARDNER, *President, Airmatic Valve, Inc., Cleveland, Ohio*

IN A ready-mix concrete plant, cement and aggregate (sand and gravel) are dropped from large overhead hoppers, weighed, and then loaded with water into the tanks of trucks. A *batchman* opens and closes the hopper gates with long heavy levers.

Not only is this a hard job, it is not efficient. Because the batchman operates the levers manually, he loses time between dropping the proper amount of material and closing the gates. This causes inaccurate mixes, wasted material, and spillage over the trucks.

Jennings Ready-Mix of Norwalk, Ohio has eliminated the batchman's job by converting to pneumatic operation. A small air compressor powering pneumatic cylinders does the job cheaper, faster, and more accurately. A 5-yard truck can now be loaded in 4 minutes, 30% faster than with the old manual system.

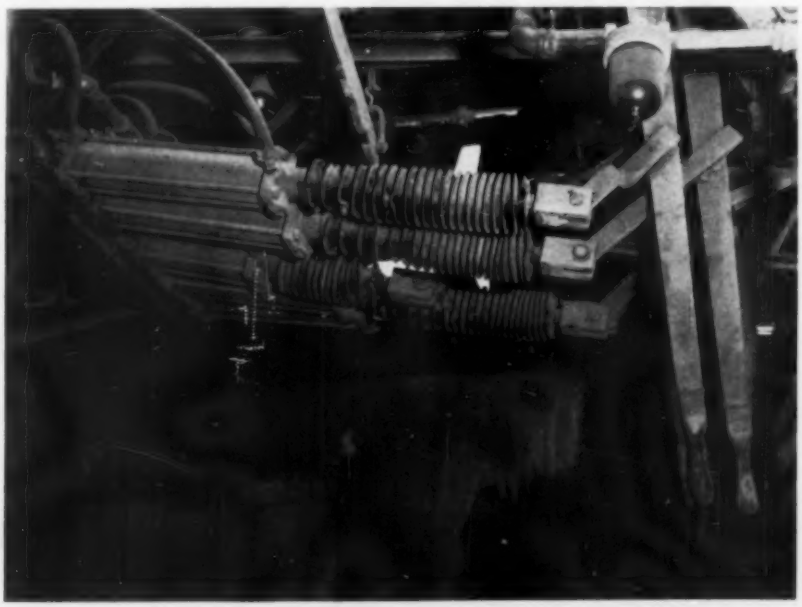
The hopper building has five hoppers and a tank. A center hopper contains cement; sand and stone are in surrounding hoppers. The air cylinders are mounted to a bracket, and the piston rods are attached to the old operating levers. Control valves are mounted directly behind the cylinders and are controlled by pushbutton switches in the weighing station below.

Solenoid-operated, spring return valves were selected because the gates have to be open only while the pushbutton switch is held. Each valve has only one moving part: a one-piece, balanced spool which rides on six O-ring packings to eliminate metal-to-metal contact.

The cylinders are 2-in. and 3-in., non-rotating. Rubber boots protect piston rods from the extremely abrasive conditions.

Jennings left the original gate operating handles, so if the compressor, pneumatic system, or electrical power should fail, the system can be quickly converted back to manual operation by disconnecting the piston rods from the levers.

The air system can be controlled by timers to give proper proportions between cement, sand, and gravel. □□□



REMOTELY CONTROLLED AIR CYLINDERS now operate hoppers. A batchman, stationed at the gates, used to do it by hand.

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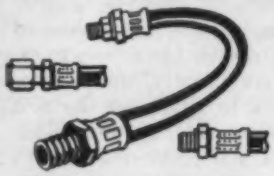

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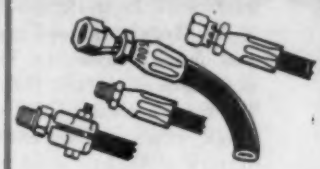

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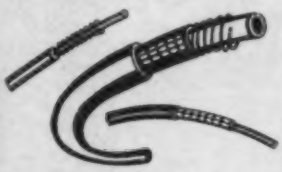

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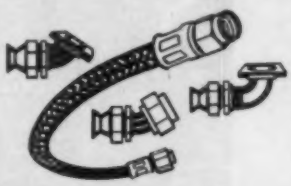

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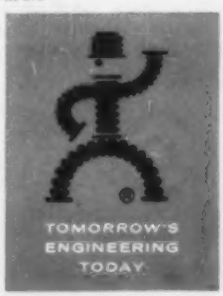

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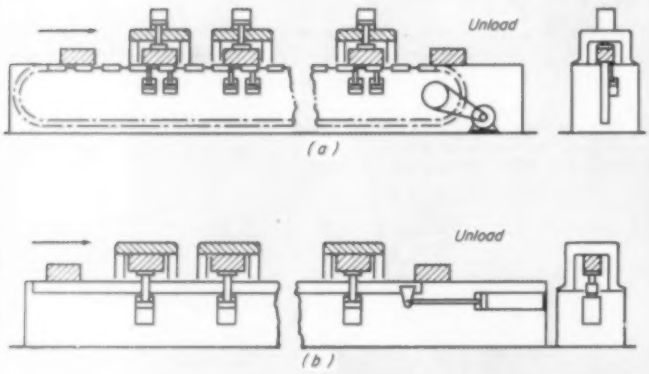
How fluid power actuates

• By RAYMOND H. DIPPLE, *Ex-Cell-O Corp., Detroit, Mich.*

Nearly every transfer machine has a hydraulic system to move parts along, as well as for tool slides, clamping, and parts handling. Here are the most common, hydraulically operated mechanisms for transferring work from one station to the next.

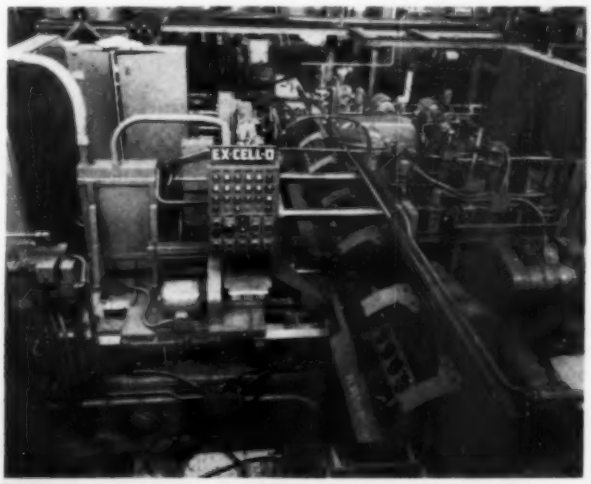


1 TWO TYPES OF TRANSFER MECHANISMS. Sketch (a) is ratchet reciprocated by an endless chain driven by an electric motor. Cylinders advance register pins in the work after transfer. Sketch (b) is simple ratchet type, in which hydraulic cylinders clamp up and convey the work.

HYDRAULIC and pneumatic components play a large part in the operation of automatic transfer machines. Five basic types of mechanisms are:

1. Ratchet—A hydraulically actuated transfer bar running the full length of the machine has pawls at each machine station. Cylinder reciprocates to advance and retract the bar. The pawls engage the lower surface of the workpiece.

2. Rotary bar—Fingers, in pairs, propel the part and check its over-run. The transfer bar rotates to extend fingers, moves the work linearly, then rotates the fingers clear of the work to return for the next cycle. Linear movement is actuated by a cylinder. Rotary movement is by rack and pinion operated by a hydraulic or pneumatic cylinder, or rotary actuator.



2 ROTARY BAR MACHINE transfers automobile cylinder blocks. Hydraulic cylinder for transfer bar is shown at right.

3 HYDRAULIC DRIVE of walking beam machine. Hydraulic motor operates through a chain-wheel reduction system and gives linear motion to transfer bar.

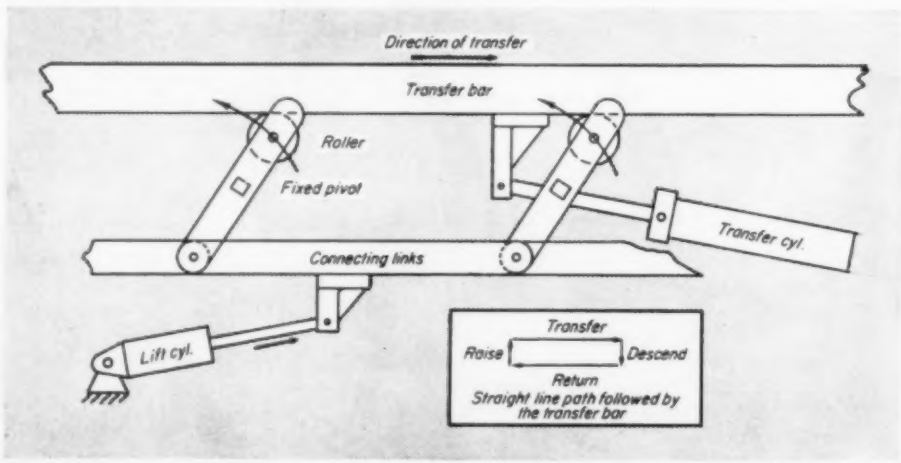
transfer machines

3. Endless chain—A chain with spring-loaded pawls on its upper run is driven by a rotary actuator. After completing the stroke, motion is reversed, and the chain is returned to its starting position.

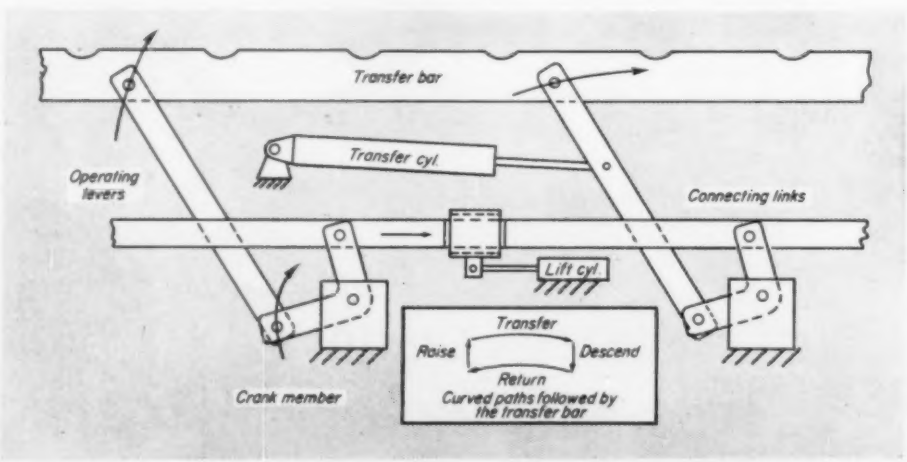
4. Walking beam—When hydraulic cylinders move levers, the transfer bar raises and lowers. A transfer cylinder moves the parts horizontally. A hydraulic motor with multiple-chain reducer can also be used to move the transfer bar horizontally.

5. Lever—This is a variation of the other systems, designed to lift or lower parts to or from a nested position. The path of movement is *raise, forward, lower,* and *return* to starting position. Linkage moves parts horizontally. □□□

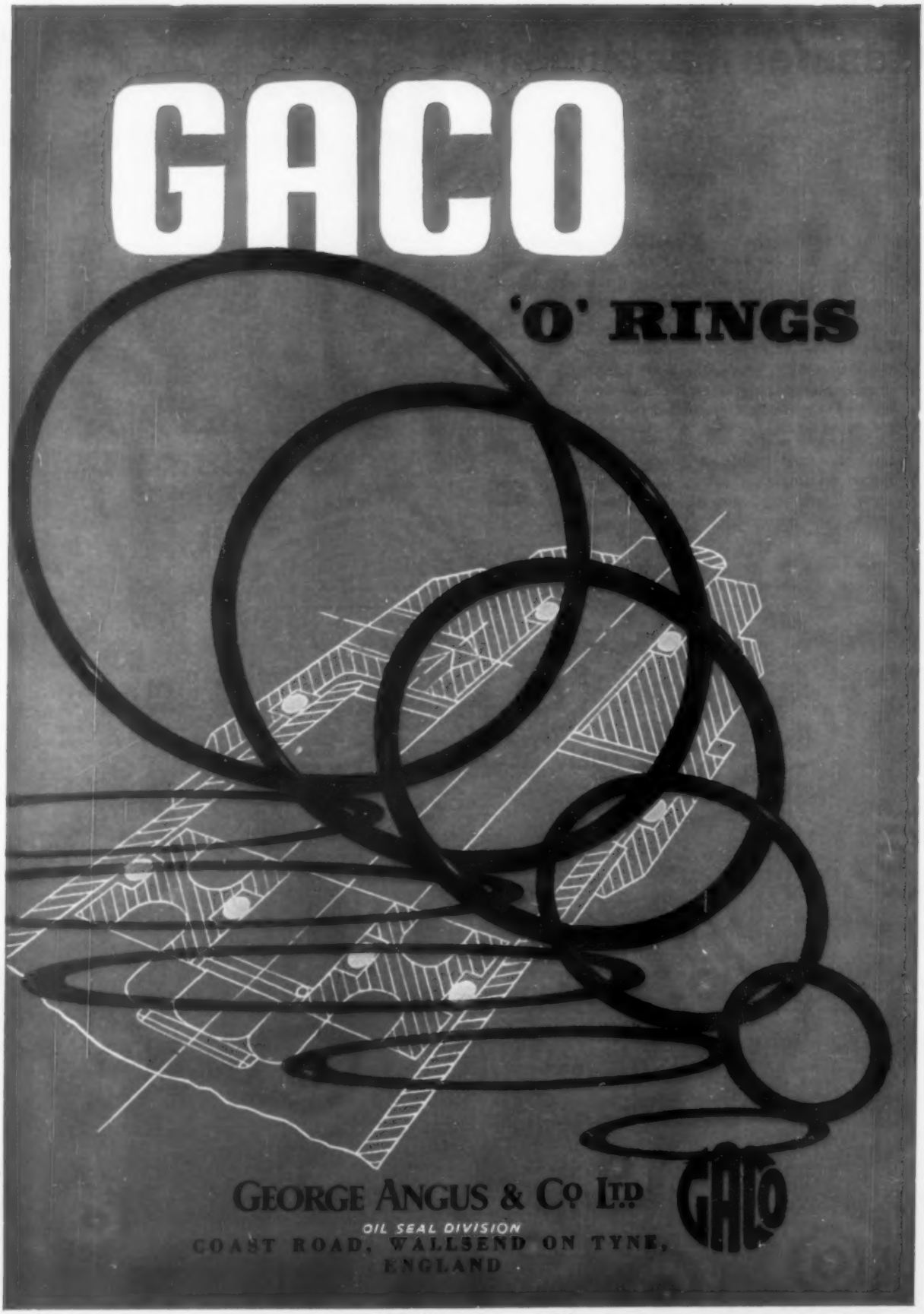
AUTOMOBILE CRANKSHAFTS are transferred on this lever type machine. The part is lifted out of half-bearing locators and transported to the next station.



4 WALKING BEAM MACHINE, using levers, in the start position. Arrows indicate motion at start of cycle.



5 LEVER TRANSFER MACHINE in the starting position. Arrows show direction at the start of transfer cycle.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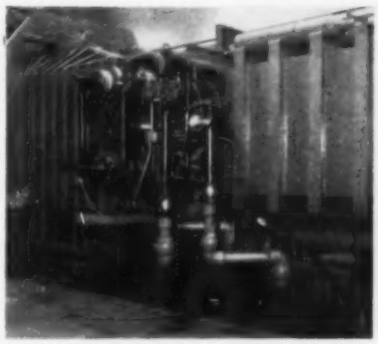
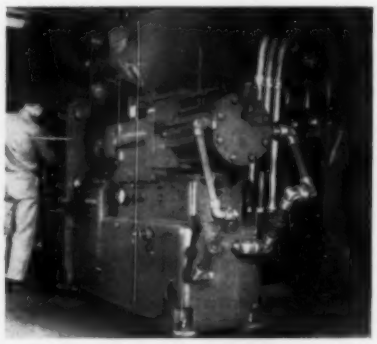
CHIKSAN SWIVEL JOINTS

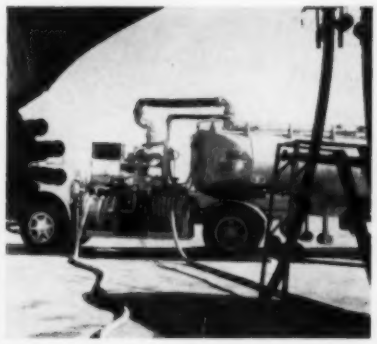
team up strength + flexibility + endurance...



QUICK DISCONNECT FOR A SUPERSONIC WIND TUNNEL—On lines that require frequent disconnecting, such as on this wind tunnel, Chiksan swivel jointed assemblies, teamed with Weco Unions, disconnect quickly, swing out of the way and then back into perfect alignment. **For application details, request report 008.**



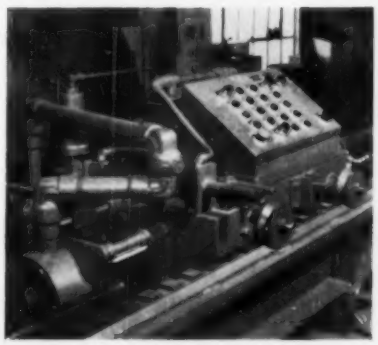
0 TO 2000 PSI IN ONE SECOND—injection molding machine lines must be flexible. Safety is a must. Endurance highly desirable. Chiksan Swivel Joints not only fulfilled these important requirements but their savings in replacement cost soon paid for the swivel joints. **For applicable details request report 001.**



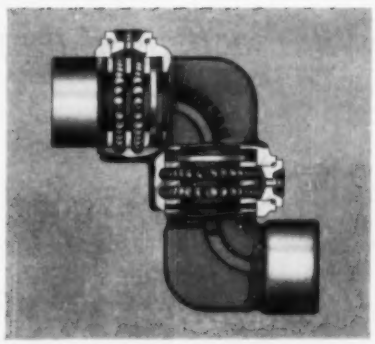
SAFETY LINK FOR JET-FUEL DELIVERIES—In design of trailer tankers for fueling jet aircraft one danger point was the suction line from pump to the trailer. By employing Chiksan Swivel Joints desired flexibility was maintained and the danger of kinking was eliminated. **For application details request report 006.**

When moving machine parts cause tight bend or twist on hose lines, Chiksan Swivel Joints are a ready solution. Or when your design dictates the use of flexible metal lines, Chiksan Swivel Joints allow controlled flexibility. Whenever line endurance, strength and flexibility are desired Chiksan Swivel Joints may offer a ready solution.

Chiksan Swivel Joints with their infinite service life, full 360° rotation and high safety factor, quickly pay for themselves by minimizing hose replacement and by eliminating costly line failure, fluid loss and downtime. For expert advice on your line design problems contact Chiksan. A nearby representative will call, analyze your requirements, and make specific recommendations.



ON THE MOVE 24 HOURS A DAY—Every five seconds right around the clock this machine tests finished pipe with water under pressures up to 1000 psi. Line movement is almost continuous. The solution. For safe, flexible lines of maximum endurance—Chiksan Swivel Joints. **For application details request report 010.**



DESIGN WITH SWIVEL JOINTS—Over 2,000 different types, sizes and styles give you an excellent selection of swivel joints for your design application.

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general characteristics

series 31 and 32

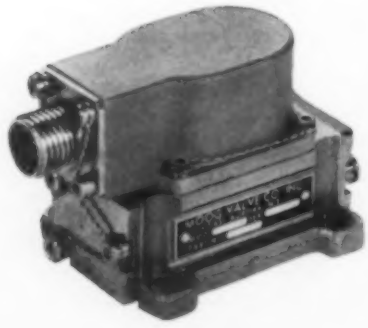
flow control

servovalves

with mechanical feedback

Maximum rated flow	valve pressure drop 1000 psi	3000 psi
Series 31	4 gpm	7 gpm
Series 32	8 gpm	14 gpm
Operating supply pressure	50 psi to 4000 psi	
Electrical signal power	40 milliwatts minimum	
Temperature range (fluid and ambient)	—65°F to 350°F standard, to 450°F or 600°F on special order	
Resolution	<½ %	
Hysteresis	<3%	
Null shift		
temperature —65°F to 450°F	<4%	
acceleration to 30g	<3%	
supply pressure 80% to 100%	<2%	
quiescent current 50% to 200% rated current	<2%	
back pressure 0% to 20% of supply	<2%	
Weight (approximate)	0.75 pounds	

from MOOG



Series 31 and 32 servovalves are miniaturized two-stage flow-control valves which utilize internal mechanical feedback. Features of the new design include high performance, simplification and compactness, together with a wide temperature capability. Specific valve characteristics can be achieved other than the ones listed above.

Write for catalog 310 and individual model data sheets that illustrate typical performance variations.

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LEADING INNOVATOR AND PRODUCER OF ADVANCED ELECTROHYDRAULIC SERVOVALVES

APPLIED **Hydraulics** & **Pneumatics**

NOVEMBER 1959

AVIATION SECTION

LOAD MAINTAINER CHECKS LANDING GEAR FATIGUE ... 110

By R. L. Gibbs

Simulated landing loads are imposed on landing gears by using a ten channel load maintainer as a central distributor. Unit and system design are explained.

AIRCRAFT FITTINGS . . . WHY THEY'LL BE MORE RELIABLE .. 114

By D. F. Collins

What's ahead in brazed hydraulic fittings is shown in some new, simple tools and connectors.

AVIATION NEWS FROM THE FLUID POWER FIELD 118

AVIATION COMPONENT DATA 120

New products, services and literature of importance to designers of hydraulic and pneumatic systems for aircraft and missiles. For more information fill in and mail post card bound in this issue.

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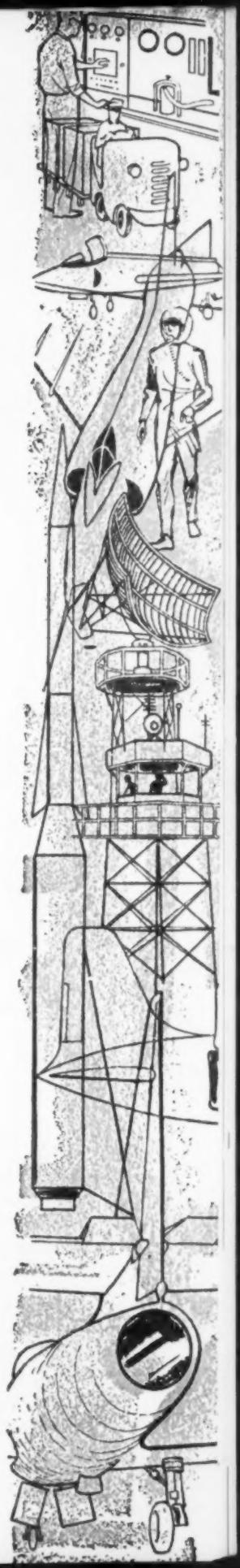
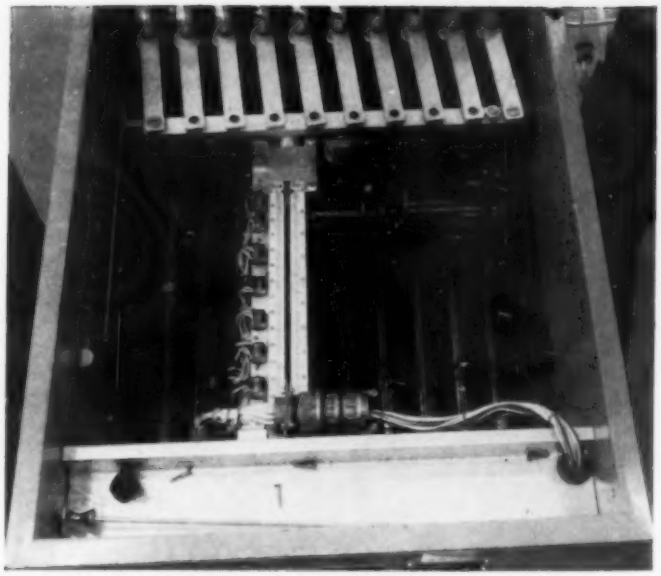


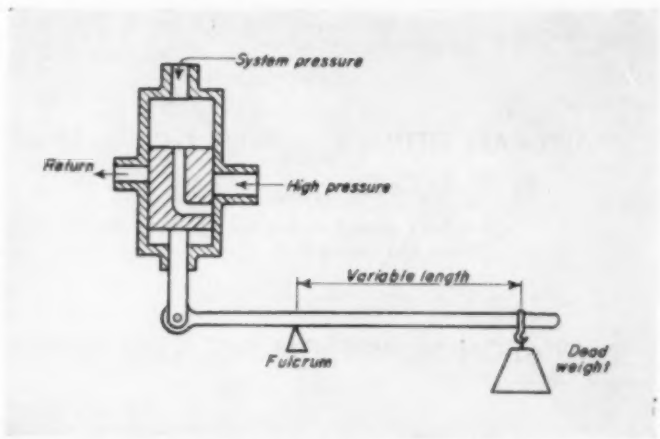
Load maintainer checks landing gear fatigue

• By R. L. GIBBS,
*Administrative Engineer, Tamar Electronics, Inc.**



LOAD MAINTAINER with control switches shown.

Ten different fluid pressures can be supplied at once by this test unit. Pressure of 5000 psi in each line (within ½ of 1% accuracy), makes it easy to simulate landing gear loads.



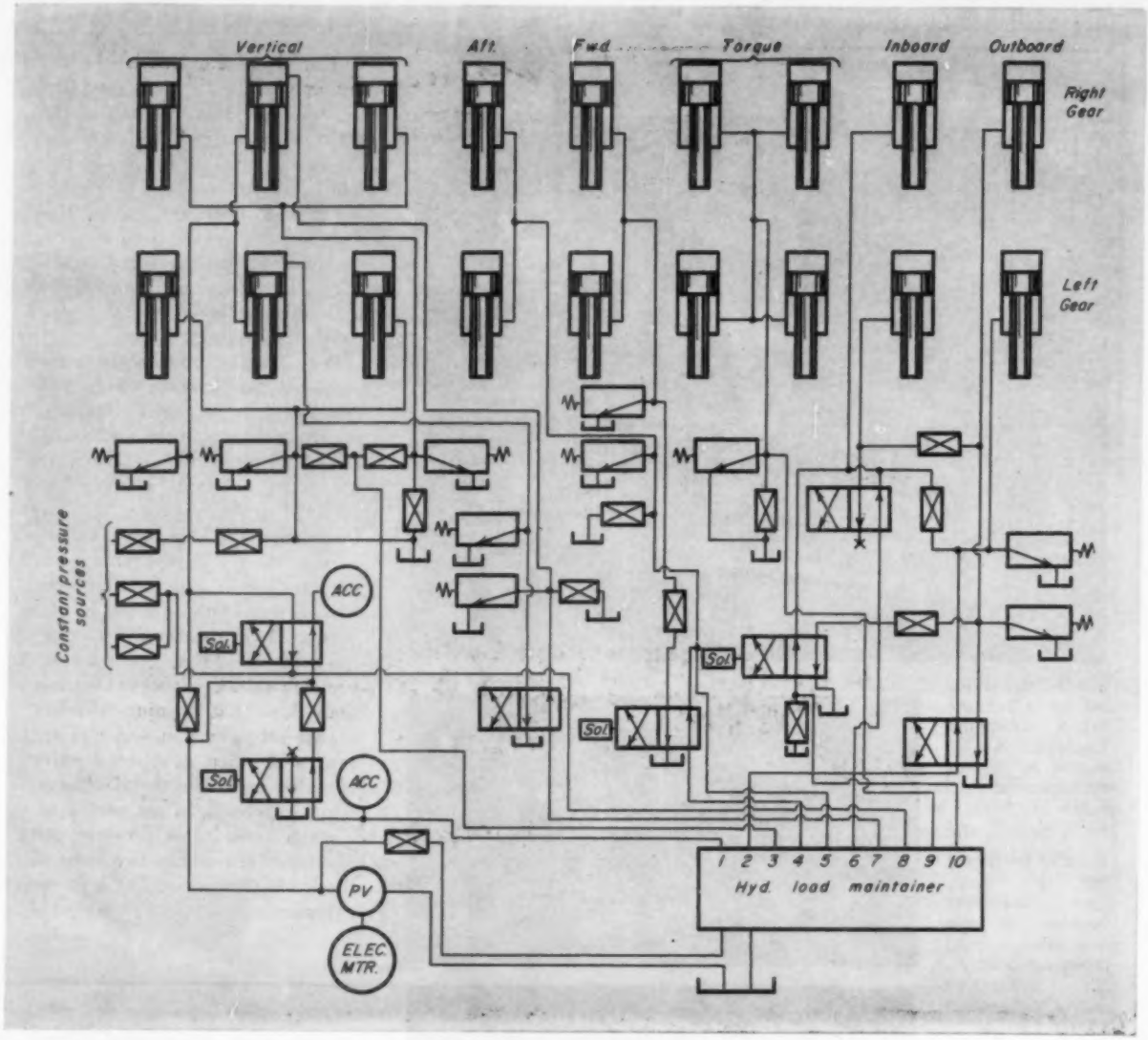
SINGLE CHANNEL of the load maintainer showing balance beam in relation to load cylinder.

A MAIN landing gear's fatigue life is an important factor which should be determined precisely in any aircraft 'est program. Landing impact, taxiing, turning, side drift, and braking forces each vary considerably in magnitude and time of occurrence. At Douglas, we gathered field data, from which 15 conditions were programmed to represent combinations of these forces. Frequency of occurrence of each of these conditions was determined from operational data and programmed into a test cycle which could be repeated any desired number of times.

• **Load Maintainer**—Using hydraulic forces to simulate loads, a hydraulic load maintainer is used as a multiple pressure source. This device is capable of receiving a constant pressure supply and redistributing it to ten separate outlet channels. The pressure in each channel can be set independently, to a maximum of 5000 psi. These preset levels can vary simultaneously between zero and 100% of maximum. Each pressure channel is self-regulating and automatically adjusts to load demand to within ½ of 1% accuracy.

Each channel of the load maintainer consists of a balance beam on a knife-edge fulcrum. The beam is balanced by a variable dead

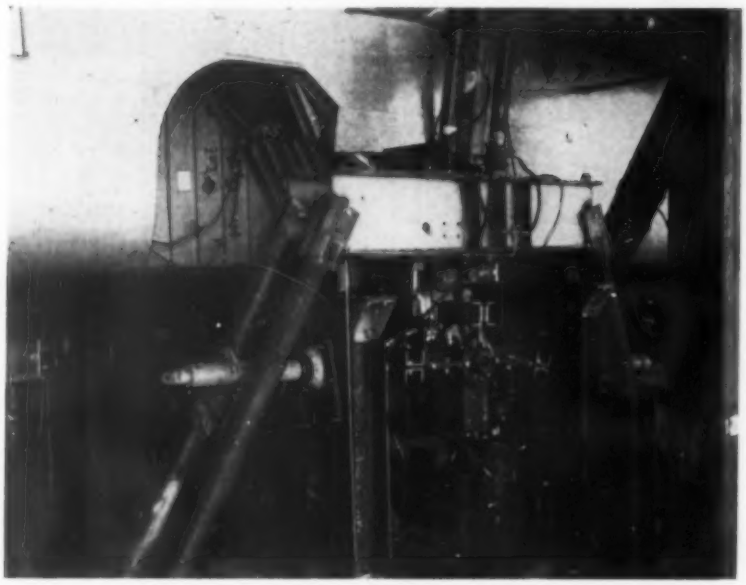
* *Formerly with Douglas Aircraft Co., Inc.*



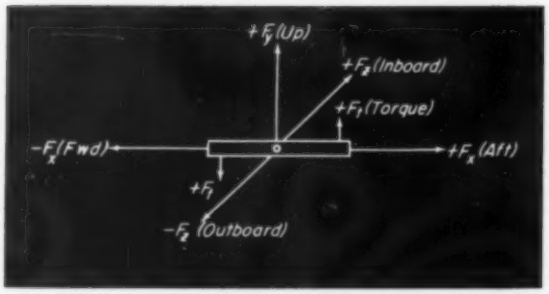
LANDING GEAR TEST CIRCUIT shows load maintainer pressure distribution to each gear. Loads vary from 1,500 to 45,000 lbs. applied along three mutually perpendicular axes. A torque force is required for certain landing conditions.

weight on one side and a hydraulic piston-imposed force on the other. When the beam is in balance, the piston covers two staggered ports of a proportioning valve. As the weight is moved toward the fulcrum, the piston moves down, partially opening the return port. The system pressure drops until the beam is again in balance. Moving the weight away from the fulcrum raises the piston, opening the pressure port. The system pressure increases until the beam is once again in equilibrium and the two valve ports are blocked off. To function properly, the available hydraulic supply flow must exceed the total demand of the loading cylinders.

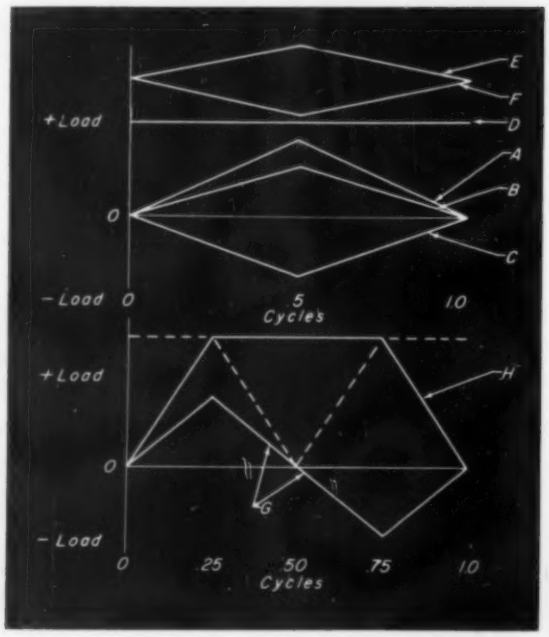
Ten such channels comprise the basic load maintainer. An internal gear train drives the weights toward or away from the knife edge fulcrum simultaneously on all channels. This basic unit was equipped with a reversible motor drive, and a number of limit switches were installed at desired intervals for the purpose of reversing the direction of weight pan travel at different points for various conditions. In this manner pressures are cycled between selected limits. The particular limit switch in control for a given cycle was determined by a selector switch. A counter is used for automatic shutdown after a pre-determined number of cycles. Each limit switch represents ten available out-put pressures (one for



LOAD CYLINDERS set up in the test fixture. Airplane fuselage is included as part of test specimen.



FORCE DIAGRAM for one gear, showing load axes relative to the specimen. All loads are positive. Sign convention refers to direction only.



WAVE FORMS of the applied loads. A, B, and C represent the basic output of a single channel of a load maintainer. Lower drawing shows the wave forms achieved by cycling a solenoid valve each time the load maintainer reaches zero per cent.

each channel).

• **Landing Gear Loads**—Forces are applied to the test specimen by nine cylinders for each of the main gears. Three cylinders along the F_y axis; two for torque ($+F_y$) load, and one each in the $-F_z$; $+F_x$; $-F_x$ and $+F_z$ axes. Hydraulic pressures required are proportional to the 15 force conditions. This program required 24 hydraulic cycling pressures and 3 constant pressures.

Wave forms indicate the force combinations possible with this equipment. A, B, and C represent the basic outputs of the load maintainer on one channel. D wave forms are constant loads applied by fixed pressure sources. E wave forms consist of D on two cylinders with an A or B on the third cylinder, and occur only in the $+F_y$ axis. F wave form is made by imposing D on the tension side of the cylinder, plus a C on the compression side. C is always kept less than D, so that the nine cylinders always act in tension. G waves are generated when a solenoid valve is cycled each time the load maintainer reaches zero per cent load. Thus a given cycle pressure can alternate between the two sides of the load cylinder, or two separate cylinders. □ □ □

Want more information about landing gear, fatigue, or test? See these articles in recent issues of APPLIED HYDRAULICS & PNEUMATICS.

3000-psi Air Systems for the Regulus
By C. G. Brock, Sept. 1959

Design for Longer Fatigue Life
By F. D. Taylor, June 1959

Design of Liquid-Spring Shock Absorbers for Landing Gear
By E. Mucha, March 1959

Cylinders Simulate Air Loading of KC-135, May 1958

Orifices Control Speed in Aircraft Arresting Gear
By R. G. Hoare, Feb. 1958

Circle 146 ➡

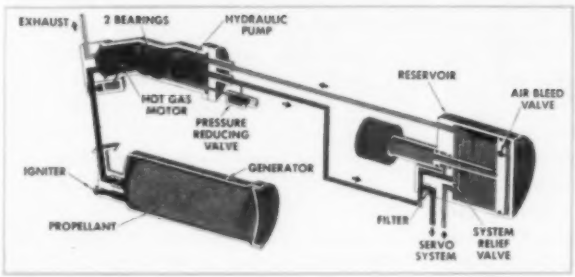
FLIGHT HARDWARE...NOW

VICKERS HOT GAS AUXILIARY POWER SYSTEMS

for missiles and spacecraft

CONCEPT

Vickers piston motors — as used in virtually all existing commercial and military aircraft — are now modified to operate efficiently on propellant-generated hot gas, or bleed gas from the main propulsion system. Minimum weight is achieved by mounting the hot gas motor "shaft-to-shaft" with a Vickers piston hydraulic pump in a common housing. The motorpump, a simple gas generator, hydraulic reservoir, filter, and relief valve are integrally mounted to form a complete Auxiliary Power System in a compact package.



DEVELOPMENT

Production line Vickers hydraulic motors have been operating on hot gas for over 2 years. Units have run on gases as hot as 2300°F without modification.

The present flight hardware was built and tested after an intensive prototype development effort. Test program motorpumps have accumulated over 100 runs each for 1 minute of operation cycle. Since the current development program is aimed at meeting known APS requirements, no limits have been established on the operating cycle duration for this type of equipment.

CONCLUSIONS

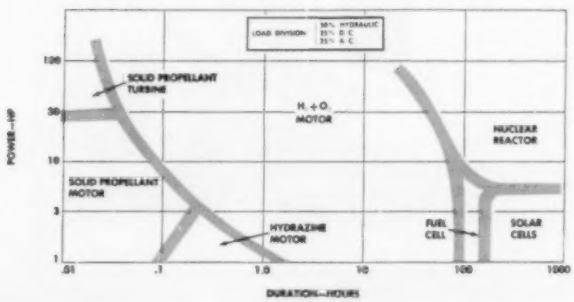
Performance and reliability goals for this concept have been met successfully. A complete hot gas APS package in the 2 - 8 horsepower range, shown above, is available within 90 days. Customer specifications for these and larger systems are invited. Write for Bulletin A-5223B.

APPLICATIONS

Because of the increasing scope of APS applications, Vickers conducted a series of studies to establish criteria for APS selection. Recent study results (published in March, 1959) indicate that for short duration operation, hot gas motors offer the best weight advantage in the 1 to 30 hp range. See curve below.

Attractive reliability and early delivery resulting from extensive use of proven hardware may extend the application of these systems to an even greater range of second and third generation missiles and spacecraft. Additional advantages include: low speed equipment (up to 10,000 rpm), convenient ground checkout, growth potential, and no alert time required.

OPTIMUM WEIGHT NON-PROPULSIVE POWER SYSTEMS



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DETROIT 32, MICHIGAN

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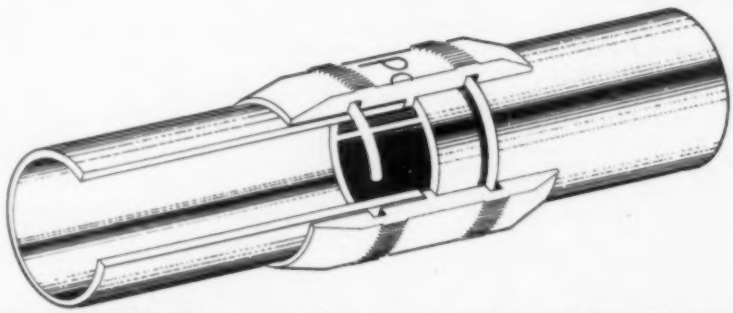
8386

Aircraft fittings . . . why they'll be more reliable

• By D. F. COLLINS, *Chief Engineer*
Aircraft & Missile Fittings Div., Parker Aircraft Co., Los Angeles, Calif.

Here's a preview of what's coming in fluid line connectors. Brazed fittings are gaining importance for permanent connections. Low torque fittings avoid installation problems where connections have to be opened for maintenance.



BRAZED CONNECTOR under development uses brazing rings. When a brazing tool heats the fitting, the rings melt and form a secure, leakproof joint.

HYDRAULIC system plumbing is being emphasized as an area for improved reliability. Tubing, connectors, and fittings are the system components most liable to human errors.

Too often designers are only concerned with routing lines around other components in the system. Design of tubing systems is regarded as a necessary evil and delegated to inexperienced designers who do not understand its role in overall reliability.

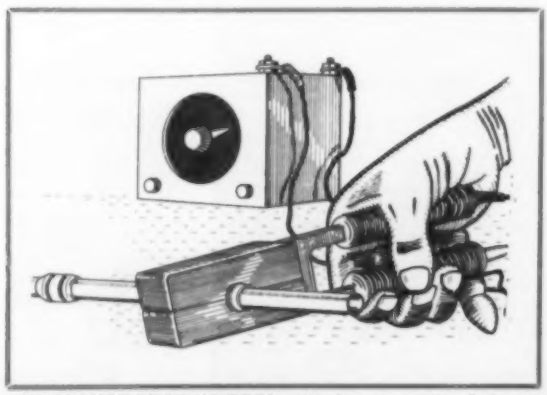
At present there is an intensive development to increase reliability of fluid power systems by reducing potential leakage points. One approach is use of brazed connections at all line joints which do not have to be disconnected for inspection or overhaul.

For connections which must be opened frequently, development is also in progress to improve couplings that require minimum installation skill. The object is to reduce effect of torque on sealing ability and to reduce the number of precision mating surfaces. Fittings of the torque-to-seal type must be carefully aligned and properly tightened for a satisfactory seal. Proper assembly dedends on skill of the installer.

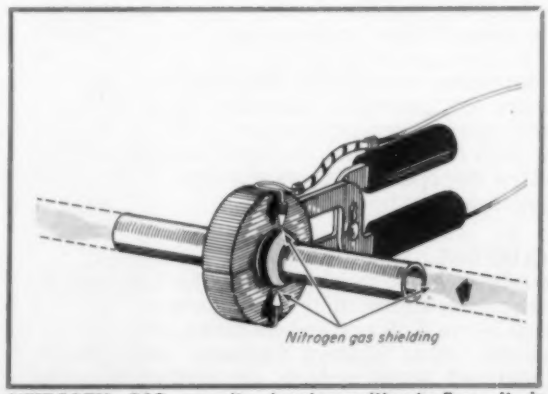
A typical brazed connection under development is shown above. To install it, you insert the tube and apply heat with a brazing tool.

A wide range of brazing materials and brazing techniques have been developed for the pressure, temperature, and fluid requirements of aircraft and missiles. The

Continued on page 116



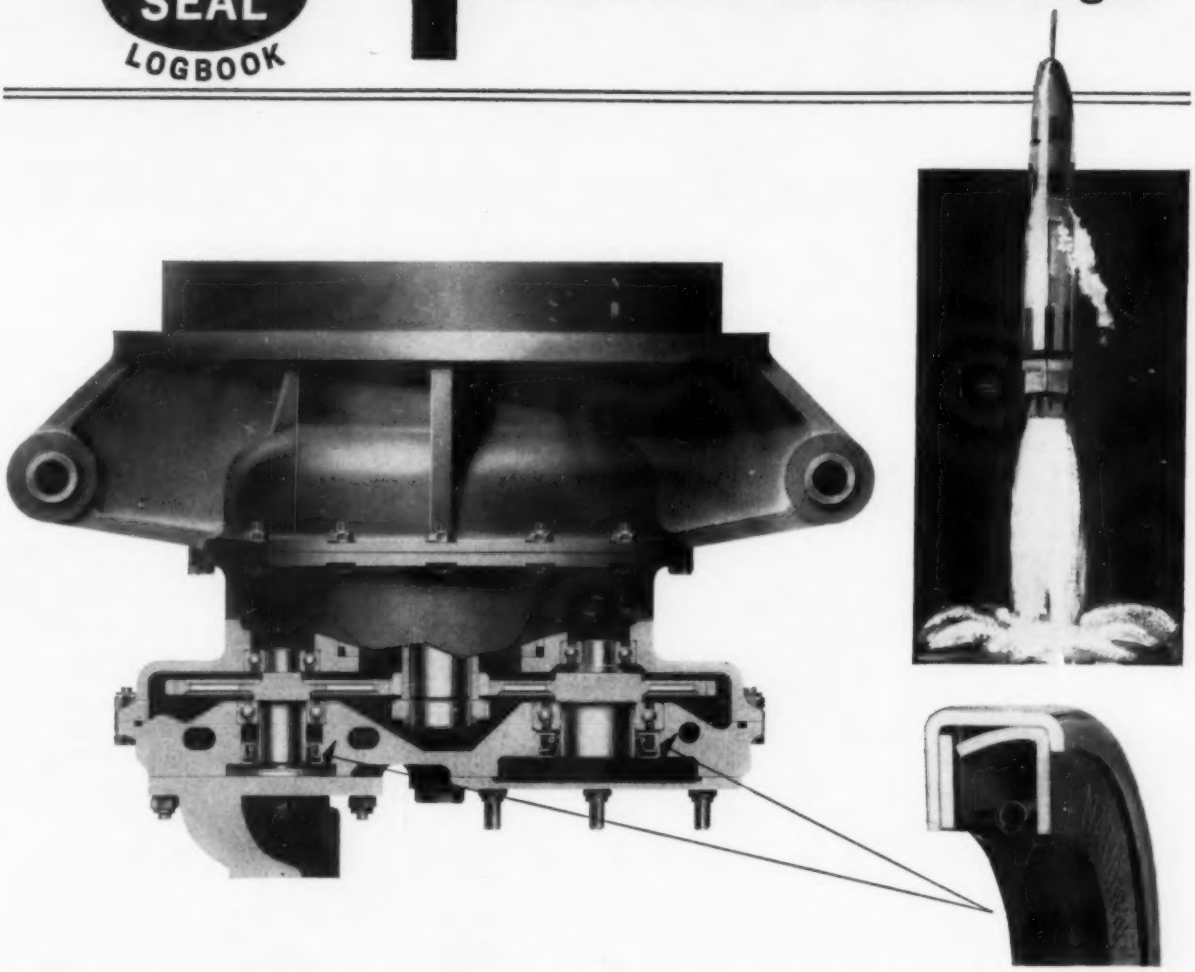
RESISTANCE BRAZING TOOL grips the connector between two electrodes. Current passing through the connector heats the brazing material. The timer maintains current flow long enough to let brazing material flow.



NITROGEN GAS permits brazing without flux. It is pumped through the system being assembled and is directed by fixtures on the brazing tool, so that it flows over the connection. The nitrogen deters oxidation and promotes proper flow of brazing material.

NATIONAL® OIL SEAL LOGBOOK

In Titan's first and second stages



Aerojet-General solves sealing problem on shafts accelerating 0 to 3,800 rpm in 1 second

Zero to 3,800 rpm in 1 second, on 1" band 1½" shafts. Synthetic-base lubricant to retain. Magnesium housing. Operating temperatures —65° F to 300° F. Utmost dependability an absolute essential. These are typical of operating conditions in the turbopump gear boxes of the first and second stages of the Titan missile.

Aerojet-General and National Seal engineers answered the shaft sealing problem on the 3,800 rpm shafts by adapting a standard-design National Oil Seal. The seal's outer case is aluminum for light weight and to match closely the coefficient of expansion of the magnesium housing. The tensioning spring is stainless steel, unaffected by synthetic lubricants. The single-lip sealing member is a specially compounded Buna N synthetic rubber, specifically designed for use with the synthetic-base lubricant.

National offers over 2,500 different standard design oil seals; provides special seals for special applications. For complete information or sealing engineering assistance, call your National Applications Engineer. He's listed under Oil Seals, in the Yellow Pages.

NATIONAL SEAL

Division, Federal-Mogul-Bower Bearings, Inc.
General Offices: Redwood City, California
Plants: Van Wert, Ohio; Downey and Redwood City, California.

5461

Circle **105** *on Time-Saver Card*

Circle **1** on Time-Saver Card

Fall Wiper Ring SPRING LOADED

The Fall "CJ"* Wiper-Scraper Ring is Spring-Loaded causing Squeeze-Grip Action on the O.D. of the piston rod during entire cycle. This patented feature maintains a uniform, continuous pressure on the wiping edge of the ring at all times, stopping any buildup of foreign matter between the ring and the rod.

It automatically takes up wear, maintaining NEW RING PERFORMANCE. Available in diameters ½" through 13" for any commercial use. AN and MS numbers in use by the Military and Aviation industry since 1944. Manufactured in accordance with MIL-S-5049. (*Closed Joint)

ACE PRODUCTS CO.

1820 N. 12th St. Toledo 1, Ohio

Est. 1935

"A.N.D." and "M.S." HYDRAULIC CONTOUR CUTTERS in stock

A.N.D. 10050 internal

Economy series; integral plain pilot

Turret lathe and drill press series; integral carbide reamer pilot

Heavy duty series; replaceable carbide reamer or plain pilot, carbide and HSS

MS33656, MS33657, MS33514, and MS33515 O.D. flat form tools

Carbide tipped High speed steel

MS33514 internal

Solid carbide, carbide tipped, high speed steel models

MS16142 internal S.A.E.

Carbide tipped; plain or reamer pilot

Write for sizes and prices.

SONNET Tool and Mfg. Co.

580 North Prairie Avenue, Hawthorne, California

Circle **132** on Time-Saver Card

materials work well at temperatures from —425 F to 1000 F.

Biggest advantage of brazed connectors is they don't depend on torque or precision mating surfaces. They are much lighter than equivalent flared or flareless fittings. With the high strength of brazed joints, they may permit using fluid lines as structural elements in aircraft and missiles.

• **Installing brazed fittings**—Whether brazed fittings will be successfully applied to aircraft and missiles depends largely on development of production techniques that permit their installation during structure assembly.

Both induction and resistance brazing promise dependable and rapid connections. Induction brazing has the advantage of quicker and more even heating of the area to be brazed. The area is surrounded by a high frequency, induction coil. Eddy current losses within the fitting produce the brazing heat.

In resistance brazing, a large current passes through the fitting. Resistance is much higher at the joining surfaces than in the material, so most of the heating is at the joint. This melts the brazing material to form a leakproof joint.

Tooling for induction and resistance brazing tube assemblies is under development. A resistance brazing tool is usually a hand-held pliers which encircle the connector. Each half of the pliers is an electrode. The operator grips the connector with the brazing pliers and maintains contact until a built-in timer switches off current.

For induction brazing, the tool has a high frequency coil which encircles the connector. A timer switches off current after a pre-set period.

A common problem in both induction and resistance brazing is proper flow and penetration of the brazing material. In other brazing jobs, this is solved by using a brazing flux. However, flux is caustic and must be removed after the job is completed. In fluid systems it would cause corrosion and contamination.

New techniques are being developed for fluxless brazing. Most promising is one that surrounds the brazing area with an inert gas to deter oxidation and promote flow of brazing material. This is done by flowing nitrogen or argon through the system.

• **Low Torque fittings for disconnect points**—In development are low torque fittings which seal by mating precision finished surfaces. They will have self-locking devices to insure proper installation. A sleeve and connector are brazed to each tube and a nut applies sufficient force to seal off mating surfaces of the sleeve and connector.

In one design, inside sealing surface of the connector is conical. The mating surface of the sleeve is spherical. Sealing depends on matching the two surfaces, not how much torque is applied. The same principle is used in a poppet type, cone check valve.

To connect a low-torque fitting, the operator engages a nut with the threads on the connector and tightens it until he reaches a positive stop. This locking insures a secure union under vibration and structural loading. □□□

In next month's APPLIED HYDRAULICS & PNEUMATICS . . .

An on-the-scene report of the SAE A-6 Committee meeting in St. Louis. This report will reflect advanced thinking on aircraft fluids, packings, hot gas systems, pneumatics, and missile system design.

Circle **117** ➡

to protect tubing, threaded or machined parts in process, storage and transit

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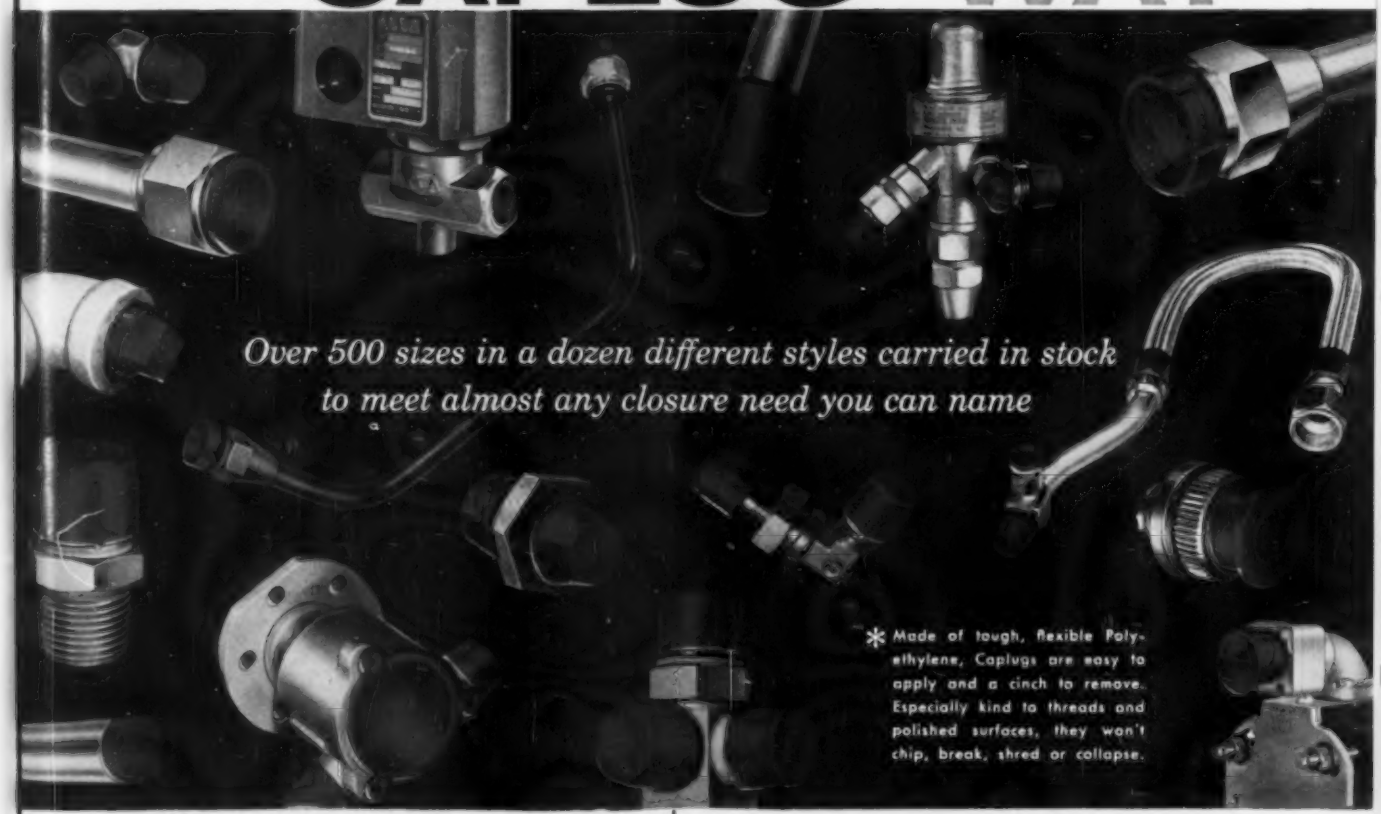

Over 500 sizes in a dozen different styles carried in stock to meet almost any closure need you can name

* Made of tough, flexible Polyethylene, Caplugs are easy to apply and a cinch to remove. Especially kind to threads and polished surfaces, they won't chip, break, shred or collapse.

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AVIATION NEWS

from the fluid power field

The Eagle missile system, for long-range defense of a task force against enemy air attack, is to be developed by an industrial group named by the **Bendix Aviation Corporation,** the prime contractor. The **Grumman Aircraft Engineering Corporation** is the major subcontractor of the group, and will develop the missile's launching system and some of the ground handling equipment.

Fred A. Klemach has been appointed Missile Systems Manager for the **Aero Hydraulics Division of Vickers, Inc.** He will be in charge of development of auxiliary power supplies and control

Klemach

systems for missiles and space vehicles. Before joining Vickers in 1957, he was president of the National Design and Research Corp.

The **Creek Corp.** of Roslyn, Long Island, N.Y., is now representing **Fluid Regulators Corp.,** Painesville, Ohio, designers and manufacturers of hydraulic valves for aircraft and missile systems. The Creek Corp. will serve the New York City, Long Island, New Jersey, and eastern Pennsylvania areas.

The **Pesco Products Division, Borg-Warner Corporation** has named **Ted R. Thoren** as vice president of engineering. He will be heading R&D engineering and be a staff member on the

Thoren

policy committee. Before joining Pesco, Mr. Thoren was staff director of R&D and assistant to the vice president of the Thompson Ramo Wooldridge Corp.

Resistoflex Corporation announces the appointment of **Air Associates** as a national distributor for flexible hose and allied products. Air Associates, with 12 branches nationally, will carry a full stock of hose and assemblies to meet FAA and MIL specifications.

Richard S. Weiss, vice president of the **Avica Corp.,** of Newport, R.I., has been named Chief Technical Engineer of the company. He will be responsible for development of advanced components for the aircraft and missile industries. **Mr. Charles Dewick** was named Chief Sales Engineer, directing liaison on special projects.

A hot gas generator spin stabilization system for the Polaris missile has been developed by the Garrett Corporation's **AiResearch Manufacturing Company.** It's lighter and more reliable than the older bottled gas systems. The propellent in the shape of a 4-inch cylinder is ignited after a specified time delay and burns at a pressure of 1000 psi for 0.2 second. Flame temperature is 3000 to 4000 F which provides a high specific impulse, low weight, and small size cartridge for this application.

J. H. Ballantoni of **Chance Vought Aircraft, Inc.,** has joined the Aviation Editorial Advisory Board of APPLIED HYDRAULICS & PNEUMATICS. With Chance Vought since 1946, he is now managing the Modular Hydraulic Program sponsored by the Navy Bureau of Aeronautics. Joe has supervised development of hydraulic and pneumatic systems of

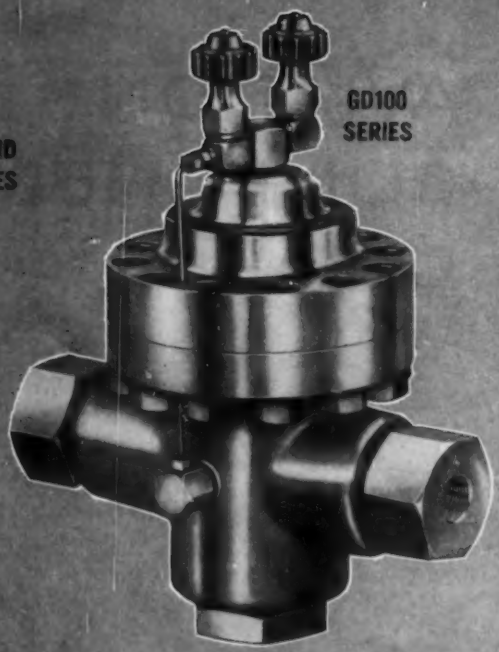
Ballantoni

the F4U-7, F7U-1, F7U-3, and the Regulus missile.

He is a member of the SAE-A-6 panel on test methods for aircraft, high temperature, hydraulic components, and is a member of the SAE-A-6C subcommittee on hydraulic pumps, motors, and air compressors.

Circle 149 ➡

GD60 AND 80 SERIES



GD100 SERIES

LR20B SERIES

Control gases safely, accurately

TO 15,000 PSI AND 50,000 SCFM WITH VICTOR REGULATORS

You get precise regulation of high pressure gases with large flow rates, because Victor employs gas pressure to control the regulating diaphragm. The result is accurate delivery from 5 to 15,000 psi with inlet pressures to 15,000 psi . . . plus ability to obtain flows in excess of 50,000 scfm at maximum inlet and outlet pressures. Chart below shows operating range of standard models.

MODEL NO.	MAX. INLET PSI	MAX. OUTLET PSI	FEATURES	MAX. FLOW SCFM
GD10	3,600	500	Single adjustment regulator control	250
GD30	2,500	2,500	Load & bleed valve control	400
GD31	3,600	3,600	Load & bleed valve control	600
GD61C	2,500	2,500	Load & bleed valve control	170
GD62C	3,600	3,600	Load & bleed valve control	200
GD65	6,000	6,000	Load & bleed valve control	250
GD65C	7,000	7,000	Load & bleed valve control	250
GD80A	5,000	5,000	Load & bleed valve control	500
GD81A	10,000	10,000	Load & bleed valve control	800
GD86R	10,000	10,000	For remote control only	1,200
GD100R	6,000	6,000	For remote control only	20,000
GD100	6,000	6,000	Load & bleed valve control	20,000
GD200	6,000	6,000	Load & bleed valve control	50,000
GD700	7,000	7,000	Single adjustment regulator control; self relieving	250
SR10	3,600	1,000	Small, spring loaded regulator	4
LR20B	7,000	7,000	Spring loaded regulator; self relieving	2
LR20BSS	10,000	10,000	Spring loaded; stainless steel	2
LV10	7,000	7,000	Loader valve control	15
BPR10	7,000	7,000	Back pressure regulator	2

Operating temperature range: −67°F. to +250°F.

. . . Yours for the asking
Take advantage of Victor's long experience with high pressure gas regulation to help solve your special problems involving flow rates, delivery pressures, corrosive fluids and temperature compensation. Write, wire or phone us today. No obligation.

All models listed are field proved. Most are designed for panel mounting or remote control. They regulate all non-corrosive gases, including oxygen. Stainless steel models available for corrosive gases and pressures above 10,000 psi. For complete specifications, write for Victor High Pressure Regulator sheets.

VICTOR for regulators

VICTOR EQUIPMENT COMPANY MISSILE DIVISION

Mfrs. of High Pressure and Large Volume Gas Regulators; welding & cutting equipment; hardfacing rods; blasting nozzles; cobalt & tungsten-castings; straight-line and shape cutting machines.

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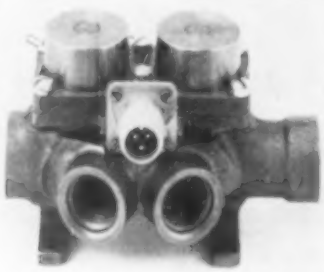
57

AVIATION COMPONENT DATA

Selector Valve
. . . is solenoid powered

The HP663100, 4-way, 3-position, 3000-psi, 275 F, solenoid-operated, selector valve has forged

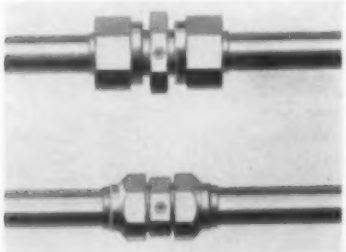


stainless body. It has only half the packings usually required. Each position is pressure actuated, eliminating dependance on springs, used for safety.—*Hydra-Power Corp., New Rochelle, N.Y.*

Circle **500** on Time-Saver Card

Flareless Fitting
. . . is lightweight

A new miniaturized flareless fitting has lightweight, compact construction and reliability over a wide temperature range. It is made of titanium alloy with properties



of corrosion resistance and high endurance strength. Available in all sizes from —2 through —32 in union, 90° and 45° elbows, and tees.—*Weatherhead Co., Cleveland, Ohio.*

Circle **501** on Time-Saver Card

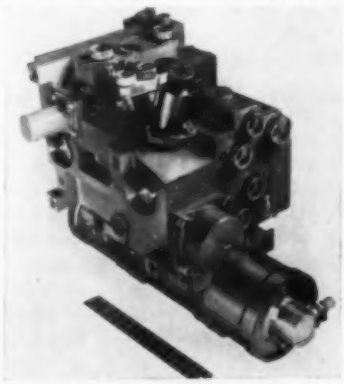
Valve Bulletin
. . . for directional, pressure controls

Bulletin describing shear seal valves, selector valves, poppet relief valves, and shut-off valves is now available. Ask for Hydraulic Controls Bulletin HC2.20.—*Whittaker Controls, Los Angeles, Calif.*

Circle **502** on Time-Saver Card

Hydraulic Package
. . . controls rocket engine

Operating at 3000 psi, this unit accepts electrical and pressure signals, and controls flow to six exterior ports and two manifolded servo



valves by means of five slide valve assemblies. Also included are a manifold, accumulator, system filter, four filters to protect servo valves, three control orifices, and two check valves.—*Hydraulic Research & Mfg. Co., Burbank, Calif.*

Circle **503** on Time-Saver Card

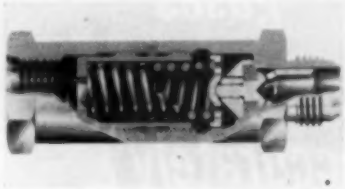
Fuel Pumps
. . . in new brochure

A new series of fixed displacement, balanced vane type pumps for jet engines is described in a 4-page brochure. Design and performance information for these pumps is charted, along with cross-section diagrams.—*Vickers, Inc., Detroit, Mich.*

Circle **504** on Time-Saver Card

Relief Valve
. . . for cryogenics

Model K5120T relief valve has body and spring of stainless steel



for cracking pressures from 100 to 2400 psi. Inline design permits easy mounting, light weight, and good flow characteristics. Tight sealing holds at normal system pressures at temperatures down to —320 F. Engineering data available.—*James, Pond and Clark, Inc., Pasadena, Calif.*

Circle **505** on Time-Saver Card

Servo Actuators
. . . are electrohydraulic

The series 17 servo actuators are integrated hydraulic packages including an electrohydraulic servovalve, a cylinder-piston assembly,

and an electrical feedback device. Typical models operate at 350 F, but special models can control in temperatures to 600 F.—*Moog Servocontrols, Inc., East Aurora, N.Y.*

Circle **506** on Time-Saver Card

Continued on page 122

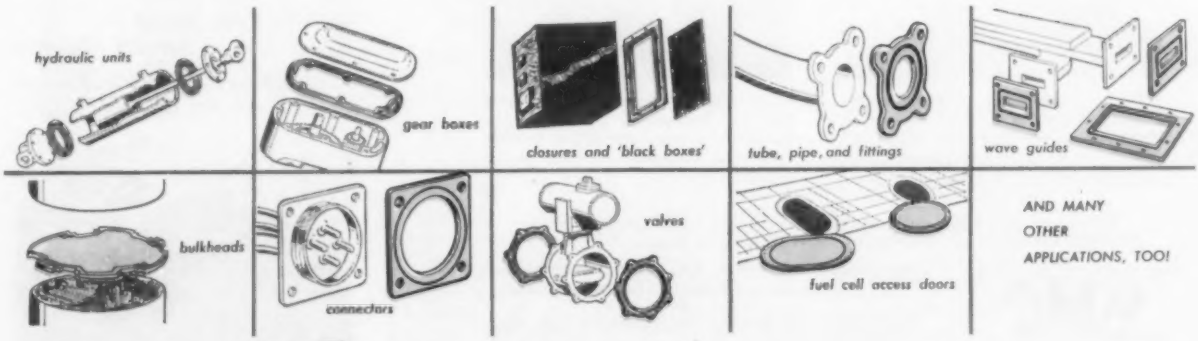
LEAKS *CAN* BE STOPPED!

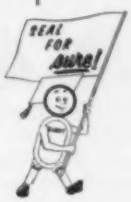
Controlled Confinement

Safe, sure sealing is vital in today's high performance machines, aircraft missiles, ground support equipment and processing equipment and *there* is a better way to seal them . . . GASK-O-SEALS.

The Gask-O-Seals shown here are static seals that can actually provide sealing that will exceed hermetic top specifications. Yet, they are mechanical, can be removed, and reused. *Controlled confinement* of the rubber makes them superior to other seals.

The "typical" applications shown are just a few of the ways Gask-O-Seals are being used. Practical, *truly* economical, no-leakage sealing. If you want to *seal* for *sure*, find out about Gask-O-Seals. Just drop us a line or use the reader service card.





Parker SEAL COMPANY

CULVER CITY, CALIFORNIA and CLEVELAND, OHIO

A DIVISION OF PARKER-HANNIFIN CORPORATION

Circle **111** on *Time-Saver Card*

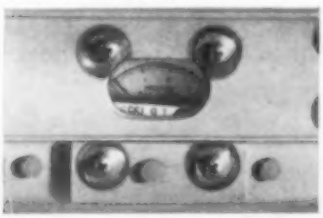
ON EVERY ATLAS COUNTDOWN RMC-LINDSAY PRESSURE GAUGES ARE CONSULTED

Used for Readout of Gas Pre-Charge in Hydraulic System Accumulators

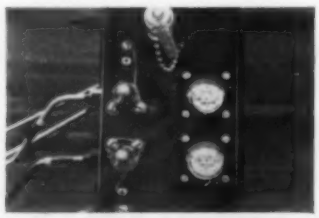
Complete reliability, freedom from jamming even under severe overloads, resistance to shock and vibration, the ability to keep functioning accurately whether setting in the desert sun or subjected to extreme cold . . . these are some of the reasons you will find 6 RMC-Lindsay High Pressure Gauges on each Convair Atlas.

These gauges must withstand shock tests of 100Gs. They are checked for accuracy in vibration tests ranging from 10 to 2,000cps at 35Gs and at ambient temperatures from −65°F to +275°F. *There is no linkage, no gear train to disintegrate or to cause pointer vibration. The indicating pointer is attached directly to the end of the helical bourdon coil.*

RMC Gauges are built to the most exacting laboratory standards for accurate performance under the most rigorous conditions encountered in modern industry, in jet aviation, in astronautics.



RMC Gauge for the booster engine hydraulic system accumulator is flush mounted on the booster engine compartment for easy reading from the outside.



RMC gauges used on sustainer of engine hydraulic system are mounted on the side of the missile fuel tank beneath a maintenance access panel.

If you have a high pressure gauge problem let RMC engineers work with you in its solution. Write, wire or phone:

ROCHESTER MFG. CO. OF CALIFORNIA
1401-C S. Shamrock Avenue, Monrovia, California

ROCHESTER MANUFACTURING CO., INC.
209 S. Rockwood Street, Rochester 10, N. Y.

RMC
LINDSAY PRESSURE GAUGES

NEW RMC PLANT IN MONROVIA

The new RMC Monrovia, California plant has been specifically designed for full scale plant production of precision instruments without sacrificing laboratory production standards.

Circle **123** on Time-Saver Card

AVIATION COMPONENT DATA

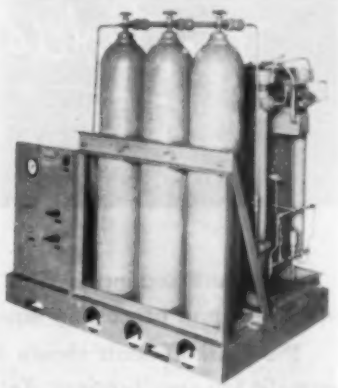
Solenoid Valve . . . data sheet

Data sheet FR 108 describes a no-leak, 2-way, pilot-operated, solenoid valve. Valve temperature range is −65 F to 275 F, for use in 3000-psi systems. Operates on 0.185 ampere, 25 volt dc.—*Fluid Regulators Corp., Painesville, Ohio.*

Circle **507** on Time-Saver Card

Air Supply . . . skid mounted

The model KC-1159 delivers up to 5000 psi of clean dry compressed air at −65 F dewpoint, for testing pneumatic system components in



conjunction with a test bench. A 15-scfm compressor with automatic blowdown and start-stop control is supplied with a bank of three 1½ cu. ft., 6000-psi storage bottles.—*Kahn & Co., Hartford, Conn.*

Circle **508** on Time-Saver Card

Mobile Test Stand . . . for jet airports

For testing hydraulic components and systems on the Boeing 707,

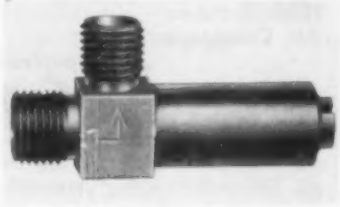
this gasoline-engine powered vehicle delivers flows from 2 to 20 gpm a pressures to 5000 psi. The stand can be towed at speeds to

20 mph. No external source of power is needed for starting or operating.—*Flight Support, Inc. Metuchen, N.J.*

Circle **509** *on Time-Saver Card*

Relief Valve . . . for high pressures

This unit has zero leakage to 700 psi with 850-psi cracking pres-



sure. Weight is 0.2 lb. maximum. A damping chamber prevents chatter. Model number 33-2139-000 is for protecting delicate parts of aircraft systems where high pressure surges occur.—*Aero Supply Mfg. Co., Corry, Pa.*

Circle **510** *on Time-Saver Card*

Fluid Filtration . . . in new cart

For cleaning oil to two microns in aircraft and missiles systems and GSE, the model 9545A fluid filtration cart can filter continuously at

a re-circulation rate of 12 gpm. Completely self-contained and portable, the cart can hold a standard 55-gallon drum, or filter fluid from an external circuit.—*George L. Nankervis Co., Detroit, Mich.*

Circle **511** *on Time-Saver Card*

Flow Regulator . . . is double-acting

The regulator meets or exceeds MIL-V-8566, with an operating pressure of 8000 psi and a temperature range of −65 F to 275 F. Tube sizes are ¼", ⅜", and ½".

Continued on next page

Unique design of new Purolator wire mesh filter medium assures better filtration over large, uniform area in smaller, lighter envelope. Available with brazed or cemented construction, in a special lightweight series or in the standard military (MS28720) approved series.

new Purolator wire mesh filter medium gives

ABSOLUTE 15-MICRON FILTRATION

Here's a new wire mesh aircraft and missile filter medium, just perfected by Purolator, that's better than anything now available. This is what it will do:

Withstand pressure differentials up to 5,000 psi

Operate at temperatures up to 400° F (higher, if required)

Filter air or any standard fluid

Stand up under cleaning and re-use

Fit in minimum space

This new Purolator wire mesh filter medium is made of stainless steel wire woven into a network with approximately 280,000 pores per square inch. Every square inch filters accurately because wire cracking at the convolutions has been eliminated. Every square inch filters completely because precision manufacture practically eliminates "dead spots" caused by patching.

Purolator wire mesh is available in several pore-size ratings. For most aircraft and missile applications, either the new element, giving absolute 15 micron filtration, or the standard 10 micron units are most widely used. For special requirements, a variety of other pore sizes is available.

Send the coupon, and Purolator will forward a new brochure containing complete details on connections, capacities, envelope sizes, relief valve sizes, etc.

Filtration for Every Known Fluid

PUROLATOR

PRODUCTS, INC.

Rahway, New Jersey and Toronto, Ontario, Canada

Purolator Products, Inc.
Rahway, New Jersey

Please send me the brochure containing complete application data on Purolator's new wire mesh filter medium.

NAME_____

TITLE_____

COMPANY_____

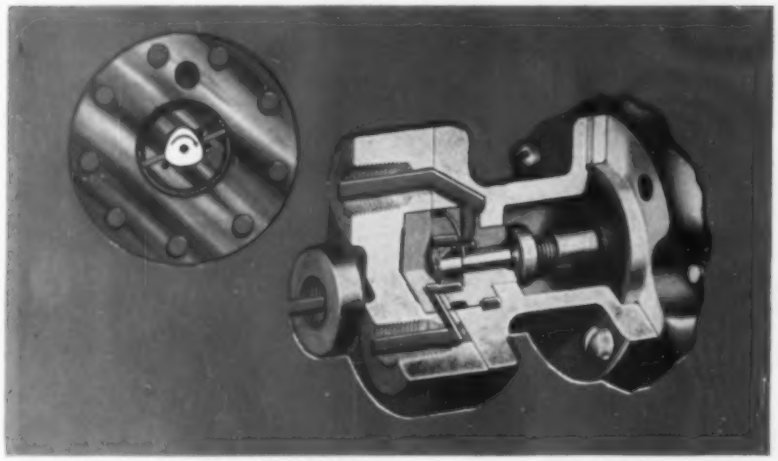
ADDRESS_____

Circle **139** *on Time-Saver Card*

YESTERDAY'S PIONEER . . . TODAY'S LEADER

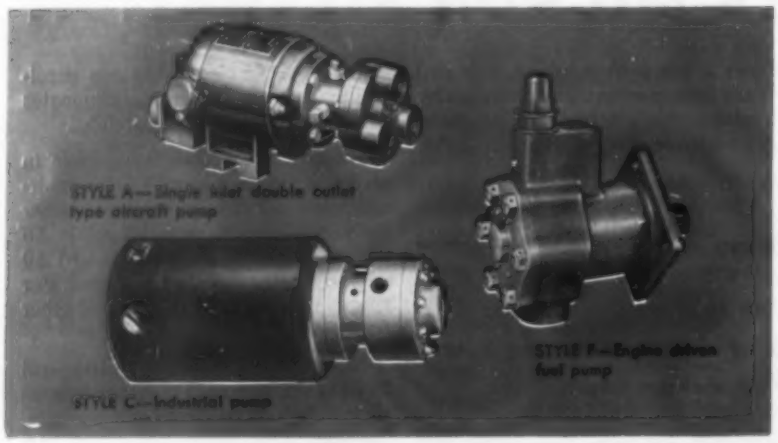
WELDON / FLUID METERING PUMPS

Positive Displacement Rotor Type. For Industrial Applications, Aircraft Anti-Icing and Aircraft Fuel.



IT'S SO SIMPLE!

The rotation of the rotor draws the fluid in through two passages, filling the cavities formed by the three lobes of the rotor. This fluid is sealed within these small cavities until it is forced through the two outlet holes by the floating blades. The flow may be kept uniformly divided through two outlet ports, or may be combined internally for passage through a single port.



COMPACT • LIGHT WEIGHT

Send for Weldon Manual and Catalog with detailed specifications and installation drawings, covering the full range of Weldon pumps in various capacities. Specify your requirements.

Over 50 YEARS OF LEADERSHIP SINCE 1918

THE WELDON TOOL COMPANY

3000 WOODHILL ROAD . . . CLEVELAND 4, OHIO

Circle **154** on Time-Saver Card

AVIATION COMPONENT DATA

Model number is A-90165.—*Vinson Engineering & Sales Corp., Van Nuys, California.*

Circle **512** on Time-Saver Card

High Pressure Air Compressor . . . is portable

Models 326 and 380 portable, high pressure air compressors for 3 and 4 cfm capacities, are for applications needing pressures to 3000 psi. Except for the first stage cylinder assembly, all parts of the two

models are interchangeable. They are useful for ground support of aircraft and missiles, testing pneumatic components, and intermittent operation of small pneumatic tools. —*The Cornelius Co., Minneapolis, Minn.*

Circle **513** on Time-Saver Card

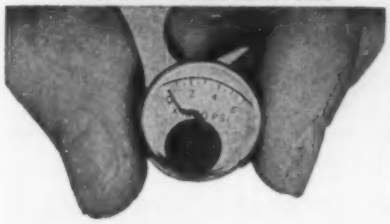
Lightweight Filter . . . of cellulose

This resin-impregnated cellulose filter element has over 1000 sq. in. of effective filtration area. The one used on the Boeing 707 transport

weighs only 12 oz. A by-pass valve is mounted in the center of the filter head. Total weight of the filter assembly is less than 6.5 lbs.—*Bendix Filter Division, Madison Hts., Mich.*

Circle **514** on Time-Saver Card

Circle **65** on Time-Saver Card



miniaturized *bh** gauges

This ***bourdon helix*** gauge, designed specifically for the Hawk missile, measures 0.75 inches across. Threads directly into the pressure vessel, reads 0-5000 psi. Accuracy is ±2% of maximum, and the gauge never requires re-calibration.

When you need special gauges, remember the name GLASSCO.

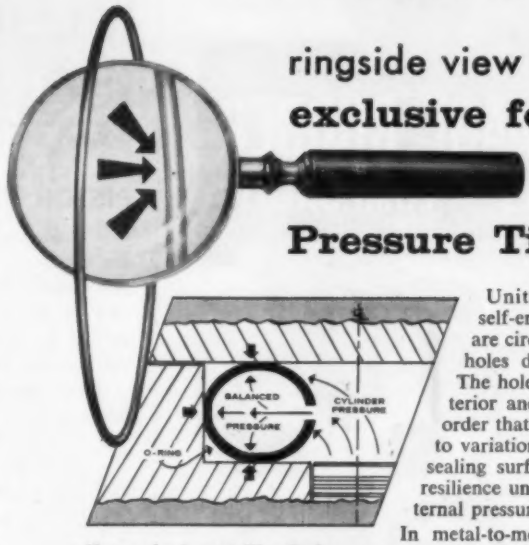
Write for Bulletin G-1223

Glassco

Instrument Company

660 S. Fair Oaks Avenue • Pasadena 2, California

Circle **142** on Time-Saver Card



ringside view of United's **exclusive feature** for

Pressure Tight Seals

United's exclusive, patented* self-energized metallic O-rings are circular tubes vented by tiny holes drilled in the ring wall. The holes are to balance the interior and exterior pressures in order that the ring may respond to variation in deflection of the sealing surfaces with a natural resilience uninhibited by the external pressure.

In metal-to-metal applications, self-energized metallic O-rings are capable of forming positive, permanent, non-corrosive static seals under extreme temperatures from —321°F. to 1800°F., and under pressures equal to ultimate compression stress of the metal itself. Available in various metals and finishes, 3/8" dia. to any size or configuration. United also makes non-vented and pressure-filled O-rings; and wire and brazing O-rings. Write for free 22-page booklet (on your letterhead please).

PATENTS 2,809,269; *2,837,360

UNITED METALLIC "O" RING CORP.

Dayton, Ohio • Box 1035

Division of United Aircraft Products, Inc.

New...from MARSH!

MARSH *Master-mite* SOLENOID VALVES

Conduit-type Master-mite. Grommet-type also available.

Small solenoid valves that fill a BIG order

Designed to meet the need for positive-acting tight-seating valves for use on wide variety of media, including oxygen, hydrogen, acetylene, etc.

Two Types:
Conduit type and grommet type. Port sizes 1/8" and 1/4" NPT.

Ten orifice sizes:
3/64" through 1/4".

Wide range of voltages:
Standard with 115 V. A. C. but also available in 12, 24, 208, 230, 460 V. A.C.

Pressure to 540 psi.

Small, but with more strength in the Marsh manner. Coils never overheat. Entire assembly leak tight. Remarkably quiet operation. Cleanable without breaking connections. Used in any position. Bodies either brass bar stock or 18-8 stainless steel. All moving parts stainless. Underwriters' approved for use on oxygen and hydrogen and as safety valves.

Write for new bulletin

MARSH INSTRUMENT COMPANY
Dept. 19, Skokie, Illinois
Division of Colorado Oil and Gas Corporation

Marsh Instrument & Valve Co., (Canada) Ltd., 8407 103rd St., Edmonton, Alberta, Canada, Houston Branch Plant, 1121 Rothwell St., Sect. 15, Houston, Texas.

Circle **97** on Time-Saver Card

NOW **A PNEUMATIC REGULATOR THAT OPERATES FROM 0 TO 5000 psi WITH *CONSTANT* OUTLET PRESSURE!**

A new light weight (3.75lbs) regulator that **guarantees** a constant outlet pressure for any setting from 0 to 5000 PSI. Specially designed for precise laboratory instrumentation, qualification testing, or field service, these regulators operate with "bottle", tank or compressor feed. They have built-in automatic relief for system protection.

AMAZING SIMPLIFIED DESIGN REQUIRES ONLY ONE ADJUSTMENT FOR BOTH RELIEF VALVE AND PRESSURE OUTLET SETTING.

- Extremely accurate sensing
- Low in cost
- Qualified
- Immediate delivery
- Inlet pressures to 6500 PSI
- From −65° to +275°F
- Hi-flow—helium, air, nitrogen
- Available for manual or electrical remote control

Write for more information. (Catalog #8225).
Note: Dealer/distributor inquiries invited.

BENBOW MANUFACTURING CORP.

11920 JEFFERSON BLVD., CULVER CITY, CALIFORNIA

Designers & Mfgs. of Valves, Regulators and Disconnects Both Airborne and Ground Support

Circle **26** on Time-Saver Card

To PROFIT MOST from precise

CUSTOM-MADE RUBBER
PARTS • SEALS • COMPONENTS

Go Goshen

Exclusive Techniques in
COMPOUNDING
MOLDING
LATHE CUTTING
METAL BONDING

If the seal or part, or component you need can best serve by being made of natural, synthetic or silicone . . . count on Goshen. Exclusive techniques developed here at GRC are available for fabricating to meet your strictest specifications, and for advance testing under many types of near-field conditions. Let us know your requirements.

Send for Literature

☐ TETRASEALS ☐ GORLUBE (Low Friction Treatment)
☐ O-RINGS ☐ GROMMETS

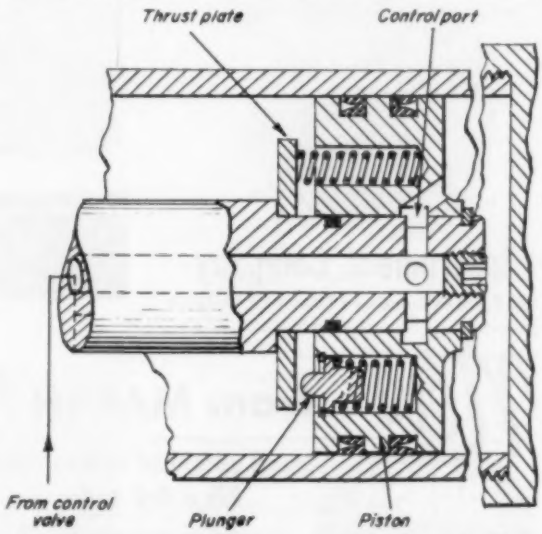
Goshen Rubber Co., INC.
1311-9 S. TENTH ST. GOSHEN, IND.

FLUID POWER PATENTS

PISTON WITH INTEGRAL CONTROL VALVE

The piston is designed for tool feed on metal working machines. Its speed is inversely proportional to the resistance offered by the tool. Fluid enters the blind end of the cylinder through a passage in the piston rod at a rate controlled by the external force acting against the rod.

The piston slides back and forth on a reduced portion of the piston rod. Fluid flowing through the rod passes through a control port before entering the blind end of the cylinder. The piston extends at full speed when there is no resistance to overcome. As the rod meets resistance, such as the tool meeting



the work, the piston slides to the left against the force of the springs, partially closing the control port.

As tool resistance increases, the piston continues to move until the spring-loaded plungers meet the thrust plate. At this point the control port opening is considerably reduced.

When the rod meets an obstruction, the piston continues to move, compressing the plunger springs. The control port closes and the rod stops. The piston remains under pressure until the obstruction is removed. It then completes its stroke.

Size of the passages and springs determine the speed of the rod and the force required to stop it.

U. S. Patent No. 2,858,804 by Oscar H. Banker, assigned to New Products Corp., Skokie, Ill.

PRESSURE CONTROL VALVE

When inlet pressure is applied to the valve, outlet pressure gradually increases to the valve setting. It is shown in its closed position with the solenoid deenergized.

Continued on page 128

THE BELLOWS AIR MOTOR®

THE ONLY AIR CYLINDER WITH A CHOICE OF BUILT-IN VALVES

In designing for air operation, the engineer can choose the method of valving he prefers—and still have all the advantages of integral valve and cylinder construction.

Six different built-in valve arrangements give the engineer every latitude in pneumatic design.

If he prefers to use 8-12 volt electrical control with its simplified wiring, Bellows has it. If he prefers to use 115 volt control and JIC standards, Bellows has it. If he requires low or high voltage explosion-proof control, Bellows has it. Should his design require full pneumatic control, Bellows has it. Or should he wish to control his pneumatic circuits manually or through mechanical linkage or cams, Bellows has it.

Unlike conventional air cylinders which require separate remote directional and speed control valves and dual piping, the Bellows Air Motor is a complete power unit with directional valve and dual speed control valves built-in as an integral part of the unit. Only one air connection, which can be made with flexible hose, is required.

Integral valve and cylinder construction means quick response, more positive response, more precise control and more economical operation.

The Bellows Air Motor is made in five bore sizes: 1¼", 1¾", 2½", 3⅝", and 4½", and in any stroke length.

***WRITE FOR THIS BULLETIN* TODAY!**

627-C

Four-color, 20-page bulletin describes the complete line of Bellows Air Motors. Free on request. Address Dept. AH-1159, The Bellows Co., Akron 9, Ohio.

The Bellows Co.

DIVISION OF INTERNATIONAL BASIC ECONOMY CORPORATION (IBEC)

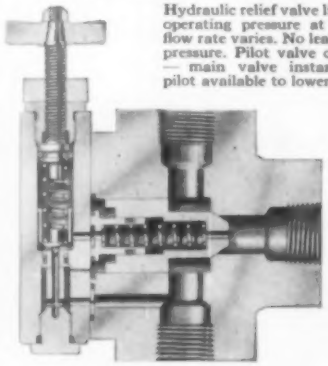
AKRON 9, OHIO

OTHER INDUSTRIAL DIVISIONS OF IBEC: Sinclair-Collins Valve Co., Valvair, Akron, Ohio • V. D. Anderson Co., Cleveland, Ohio

REPUBLIC VALVES
FOR EVERY INDUSTRY

RELIEF VALVES
WITH
• EXCLUSIVE FEATURES
• SMOOTH OPERATION
• LONG LIFE

PILOT-OPERATED RELIEF VALVE

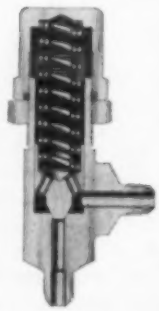


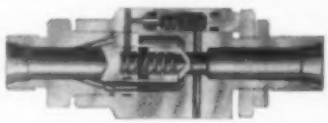
Hydraulic relief valve limits system's maximum operating pressure at constant level, though flow rate varies. No leakage loss below cracking pressure. Pilot valve controls pressure setting — main valve instantly conforms. Remote pilot available to lower setting of integral pilot control. 3 pressure ranges: 50 to 1200 psi; 1000 to 3000 psi; 2500 to 5000 psi. 50,000 tensile semi-steel body standard aluminum alloy to order. FMP or str. thread gasket seal bosses, ¼" to 1¼". Panel mounting bosses.

Modified units available as Sequence Operating Valves; and as Unloading Valves for clamping or other two-pressure applications.

POPPET TYPE RELIEF VALVE

Smoothly sliding poppet, seated by a stainless steel compression spring is the simple design of this rugged unit. External adjustment. Two types of sealing elements available. Soft seal poppets for air, gas, and liquids, with no leakage; stainless steel poppet for general hydraulic applications. Other poppet materials available for special chemical services. Eleven pressure ranges to 2750 psi, ⅛" to ¾" pipe, tubing, internal straight threading. 250°F std — specials to 400°F. Aluminum alloy, brass, or stainless steel.





ADJUSTABLE IN-LINE RELIEF VALVE

External relief adjustment without breaking line is the feature of this 5000 psi relief valve. Limits hydraulic system's maximum pressure at constant level, with minimum rise above cracking pressure. Turning locknut on body varies relief pressure adjustment spring in pilot valve. Free reverse flow. 2 pressure ranges: 50 to 2500 psi; 2000 to 5000 psi. Stainless steel body with hydraulic o-ring, -65° to 160°F standard. Packings for other fluids, and higher temperatures available. Flare or flareless tube connections ½" and ¾".

Distributors in principal cities coast to coast

CHECK RELIEF SELECTOR GLOBE NEEDLE PLUG

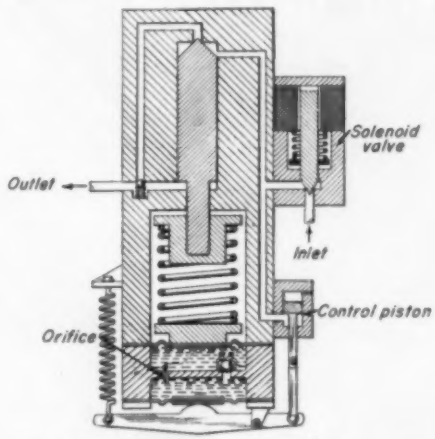
283

RM REPUBLIC MANUFACTURING CO.
15655 BROOKPARK ROAD • CLEVELAND 35, OHIO

Circle **120** on *Time-Saver Card*

The two lower chambers are filled with a silicone oil. They are connected by a check valve and an orifice.

When the solenoid is energized, the inlet port opens and fluid flows through the body passage to the bottom of the control piston. The control piston retracts, releasing the upward force on the lower diaphragm. The main valve spring, acting on the upper diaphragm,



forces oil through the orifice into the lower chamber. As oil is forced out, the spring extends and its force is reduced.

The equation for valve operation is:

$$P_1A_1 = P_2A_2 + \text{spring force}$$

Where,

P_1 = Line pressure
A_1 = Area of main valve plunger
P_2 = Outlet pressure
A_2 = Differential area on bottom of main valve plunger

P_1, A_1, & A_2 are constant. The only variables are outlet pressure and spring force, both tending to close the valve.

As the valve spring extends, due to oil being forced out of the upper chamber, outlet pressure gradually increases. Spring can be designed to extend fully and final outlet pressure will equal inlet pressure.

Outlet pressure can range from 0 to inlet pressure, depending on the spring force when fully extended.

When inlet pressure is shut off the tension spring extends the control piston and forces the silicone oil through the check valve into the upper chamber. The valve is then ready for another cycle.

U. S. Patent No. 2,877,796 by Joseph T. Abdo, Los Angeles, Calif.

Other Patents Issued

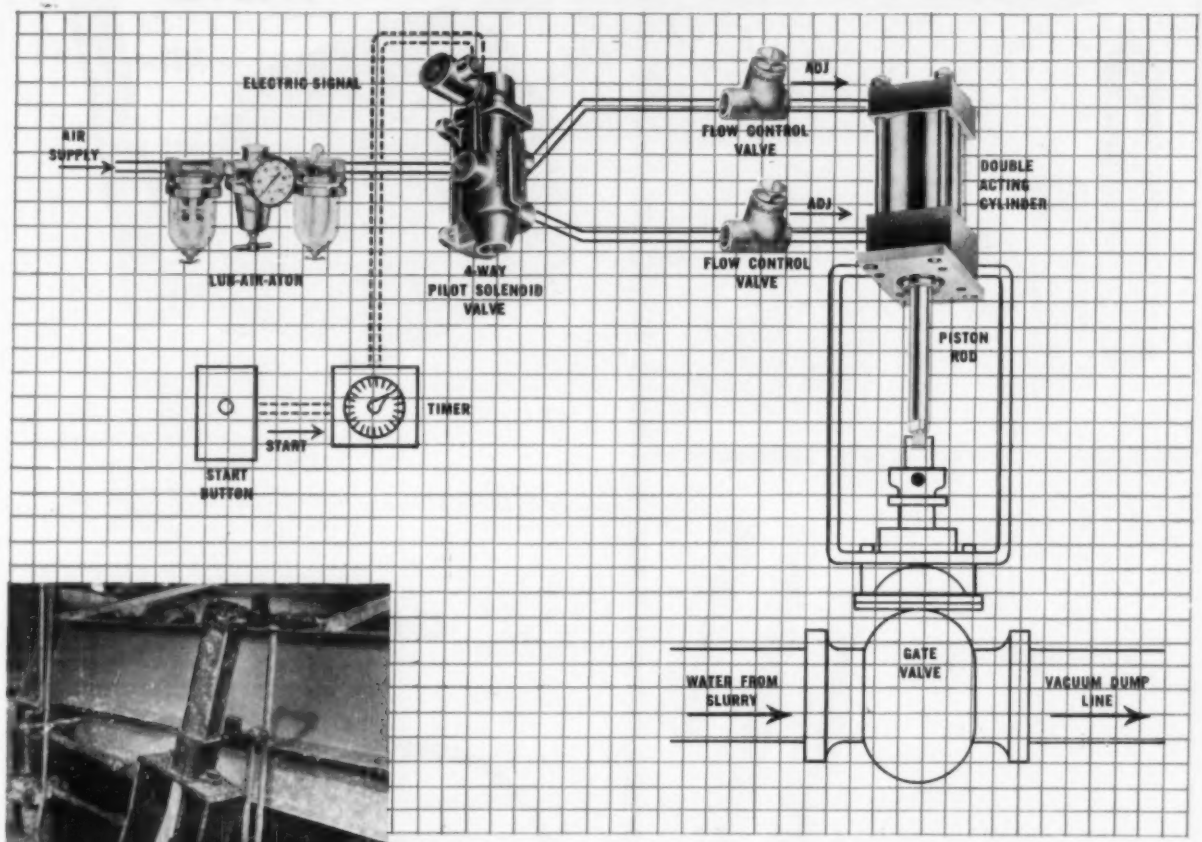
PRESSURE LOADED PUMP

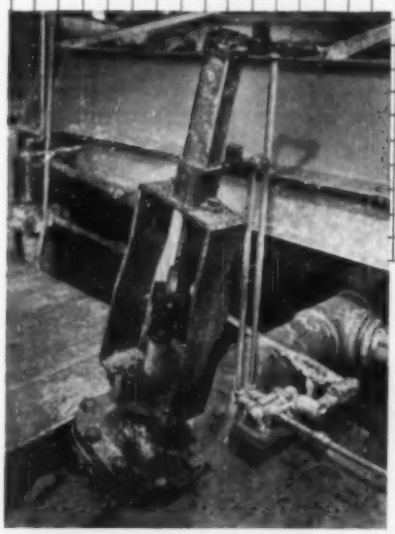
No. 2,884,864 by Louis R. Bobnar, assigned to Borg-Warner Corp., Chicago, Ill.

CYLINDER CUSHION

No. 2,884,903 by Joachim W. Pauly, assigned to Westinghouse Air Brake Co., Wilmerding, Pa.

PROCESSOR SPLITS PRODUCTION BOTTLENECK WIDE OPEN WITH HOOKUP OF STANDARD SCHRADER AIR PRODUCTS





Here's how one company automates with air. The hookup of Schrader Air Products in the large diagram actuates gate valves used in processing a slurry of raw asbestos fiber and cellulose at The Republic Seitz Filter Corporation, Newark, N. J. This used to be a slow, arduous manual job. Now air does it quickly, effortlessly, under "conditions particularly difficult for most kinds of automatic equipment . . . without a minute's downtime and without any maintenance whatever," says the company's Technical Director. Schrader-trained air specialists helped plan this practical set-up, as they have helped plan countless others.

Boost productivity of even complex operations quickly and economically, like this company . . . with *air!* Plan it yourself, or let our experts help. A system of Schrader Air Products can simplify almost any bottleneck job . . . whether it's processing, assembling, testing or packaging . . . pushing, pulling, holding, positioning or moving work repetitively.

With Schrader Products, you can run practically any production line faster, safer, more economically—and with tireless accuracy! Maintenance is surprisingly low.

These are benefits every shop needs. Take advantage of them all when you automate with Schrader . . . the finest, the most complete line of Air Cylinders, Valves and Accessories . . . plus countless ideas for cutting your operating costs.

Select air controls from the full Schrader line. Your Schrader distributor can help you pinpoint what you need. For more data, write:

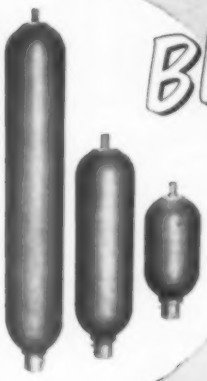
A. SCHRADER'S SON
Division of Scovill Manufacturing Company, Incorporated
456 Vanderbilt Avenue, Brooklyn 38, N. Y.

Schrader®
a division of SCOVILL

QUALITY AIR CONTROL PRODUCTS

Circle **127** *on Time-Saver Card*

GREER Headquarters for ACCUMULATORS



BLADDER ACCUMULATORS

OVER 100,000 SOLD, some in continuous use for more than 15 years — proof of superior reliability, safety and dependability in a wide variety of circuit applications. Standard models available in two operating ranges: 0-3000 psi and 0-6000 psi, from 1.5 cu. in. to 2080 cu. in. capacities*.

WRITE FOR CATALOG PR-200.

PISTON ACCUMULATORS

A NEW LINE of piston accumulators for standard industrial performance. Features extra built-in safety. Available for 3000 psi operation in nine sizes from 10 cu. in. to 2250 cu. in.capacities.

WRITE FOR BULLETIN IPA-1.

SPECIAL ACCUMULATORS

FOR AIRCRAFT, MISSILE or industrial applications requiring bladder accumulators in special shapes, sizes or operating characteristics. Standard bladder-type transfer-barrier accumulators available in two pressure ranges: 0-3000 psi an 0-6000 psi in a variety of sizes*. Contact your Greer representative with your requirements.

*U.S. Licenses under Olaer Patents

Most Experienced Designer and Producer of Accumulators

GREER HYDRAULICS, INC.

N.Y. International Airport, Jamaica 30, New York • OL 9-9700

Distributors and Other Representatives in Principal Cities

Circle **158** *on Time-Saver Card*

Circle **69** *on Time-Saver Card*

GRESEN HYDRAULICS

DOUBLE SELECTOR VALVE

Model DS-75

FEATURES: Cast iron body—chrome plated, pressure balanced spool—Easy to mount —Three optional handle positions.

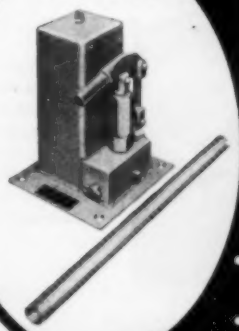
SPECIFICATIONS: Capacity—24GPM @15 ft/sec.
Pressure range—0 to 1500 PSI
All openings—¾" NPT
Shipping weight—12 lbs.

WRITE FOR LITERATURE

GRESEN *Mfg. Co.*

405 35th Ave. N.E., Minneapolis 18, Minn.

CATALOG NO. 160



Hand Hydraulic Pumps

- Single and Double Designs to 20,000 psi
- With or Without Reservoir

160 cubic inch reservoir with 8"x 8" base plate and 18" long handle.

Available with optional size pistons ⅜", ½", ¾", 1" and 1½".

We specialize in the manufacture of hand pump units which operate in temperatures from −65° F. to +160° F. and with any capacity reservoirs required. Pumps can be furnished on special order with custom seals to handle various aircraft types of fuels such as Pydraul, Skydrol, Oronite, etc.

The single pump with ½", ¾", 1" or 1½" piston is now available in stainless steel.

for additional information write:

WILLIAM S. PINE

hydraulic hand pumps for 1001 uses

1635 East 22nd St., Los Angeles 11, Calif.

Circle **115** *on Time-Saver Card*

NEW PRODUCTS

Continued from page 60

HIGH PRESSURE FILTERS . . . to 1000 psi

Designation: P-192 Series
Features: Filter lubricating oils, hydraulic fluids—including mineral oil base, silicate esters, and diester oil base—oils, air, and gases. Any model can filter other fluids if proper gasket material is substituted. Permit use of replaceable paper elements, wire mesh, or

varied-spacing, metal-edge filtering media. Clamp lock-ring construction on steel housing provides easy element change, without need of disconnecting filter from circuit. Furnished with mounting brackets, inlet and outlet connections, internal relief valves.
Specifications: Filtration range from 2 to 25 microns. Temperatures to 275 F. Relief valve pressures from 15 to 55 psi.

Purolator Products, Inc.
Rahway, N.J.
Circle **611** *on Time-Saver Card*

POWER CHUCKING UNIT . . . installs in 90 min.

Features: Designed to convert Models 2 and 2G Brown & Sharpe Automatic Screw Machines to air chucking. Especially useful for chucking cold drawn and odd shaped parts. Has 4" air chuck with 2 or 3 jaws, soft blank workholding top jaws, threaded draw bar, rotating air cylinder, flexible air hose and fittings, cylinder adapter, 3-way control valve. Addition of automatic feed hoppers, work ejectors, and automatic cam controls permits operator to tend more than one machine.

Skinner Chuck Co.
New Britain, Conn.
Circle **312** *on Time-Saver Card*

Continued on next page

Actual unretouched photos of MARSH 616 Square-Shouldered Cups and Square-Shouldered Flange used in the test below

MARSH 616 gives the most rugged packing for severe operating conditions — sealing petroleum hydrocarbons and aqueous or non-aqueous base fire-resistant fluids. Temperature range: –65° to +212° F. Made of . . .

Thermo — the finest retan packing leather — condensed in area and thickness to create toughness and higher tensile strength with . . .

Elastomer impregnation with polymerization within the leather structure. The resulting polymer has *no melting point* and cannot be removed by any hydraulic fluid.

RECENT RESULTS IN PYDRAUL* F-9 PHOSPHATE ESTER BASE FLUID show the "universality" of the MARSH 616 packings.

1. LESS than 2% swell by volume.
2. STATIC SEALING for 12 months at 5000 psi with no leakage.
3. CYLINDER TESTS under load, with temperatures up to 130°F—1,000,000 strokes with positive seal and no packing damage.
4. SATISFACTORY field application.

NOTE: Complete test reports on the Pydraul test results are available upon request.

*MONSANTO CHEMICAL CO. T.M. REG. U.S. PAT OFF. FIRE-RESISTANT FLUID

WRITE FOR OUR NEW BROCHURE COVERING THE 612 BACK-UP WASHERS MADE OF THERMO AND ELASTOMER

SINCE 1900

C·W·MARSH COMPANY

MAIN OFFICE AND FACTORY: MUSKEGON, MICHIGAN

SALES OFFICES: 3756 West Devon Ave. Chicago 45, Ill. | 101 Park Avenue New York 17, N. Y. | 1900 Euclid Ave. Cleveland 15, Ohio

Circle **96** *on Time-Saver Card*

NEW PRODUCTS

AC INDUCTION MOTORS
. . . for higher hp, constant speed

Features: Drives for pumps, fans, blowers, and compressors. Several bearing constructions offered. To inspect and maintain motors' capsule type sleeve bearing and oil rings, top half of split bearing bracket and split bearing capsule

are removed. Bronze inserts in bearing capsule provide close-tolerance running fits between capsule and shaft. Motors for 3600 rpm, 1000-hp ratings and larger have separate-motor lubrication system. Ventilation system achieves minimum motor noise levels.

Specifications: Drip-proof enclosures. Ratings from 150 to 2000 hp at 1800 and 3600 rpm.

The Louis Allis Co.
Milwaukee, Wisc.
Circle **313** *on Time-Saver Card*

ON THE JOB...

with CROSS HYDRAULIC CYLINDERS

Stay "on the job" with dependable, rugged Cross Hydraulic Cylinders. Like Cross customers everywhere, you too, will appreciate the fast, courteous, dependable service you get from Cross. Phone for speedy delivery on any quantity...quality-built to your specifications. Contact Cross Engineering Department, today!

- RUGGED
- DEPENDABLE
- ECONOMICAL

CUSTOM DESIGNED CYLINDERS FOR EVERY APPLICATION

Try CROSS CYLINDERS in your operation... low cost, dependable, and trouble free.

Lowest-Priced Engineered Quality Cylinders Available..

trade mark of Quality in Hydraulic Cylinders...

CROSS MANUFACTURING CO.
LEWIS, KANSAS – PHONE EA 4-5525

WRITE • WIRE • PHONE...TODAY!!

Circle **41** *on Time-Saver Card*

AIR CYLINDERS
. . . save space

Designation: Pancake line

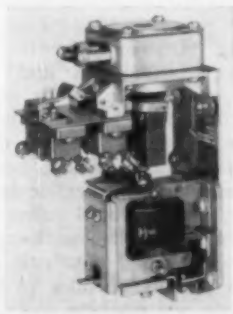
Features: Cylinders permit use of air pressure within space limitations which have precluded it. Developed for faster tooling.

Specifications: Three sizes in push type available with OD to 3¼". Pull type, specials, other sizes designed and quoted on request.

Fabco
Cleveland, Ohio
Circle **314** *on Time-Saver Card*

TIMING RELAY
. . . has two snap switches

Features: Pneumatic timing relay has two normally open, two normally closed timed contacts. Two single-pole, double-throw snap switches used for timing contacts. Each can be separately adjusted to

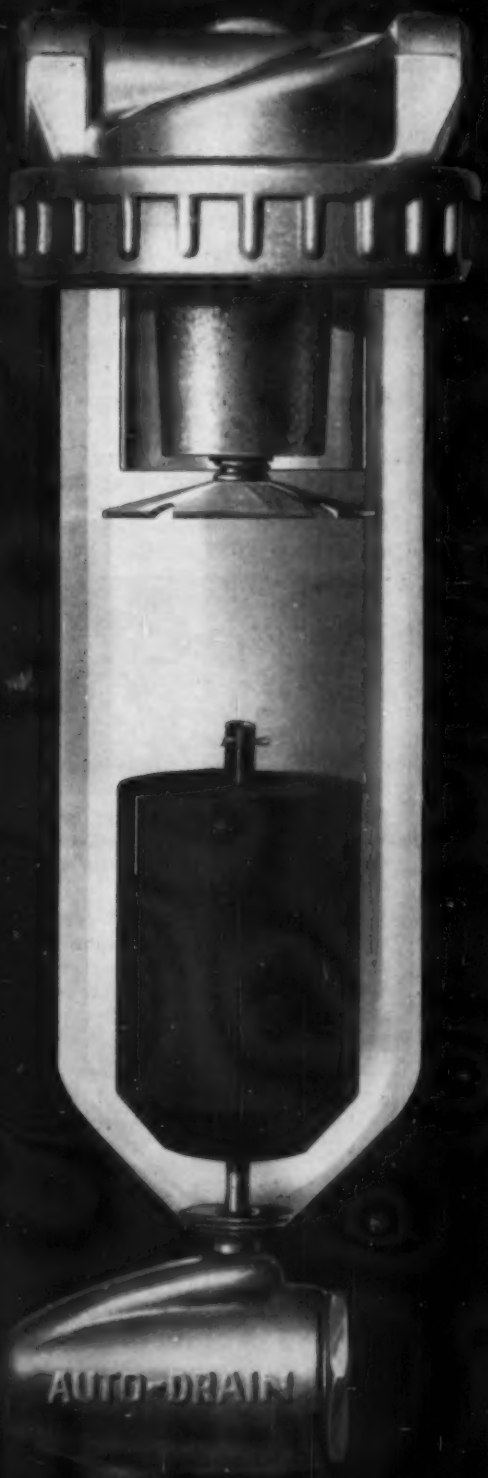


provide definite timing sequence. Up to two, instantaneous, single-pole, double-throw interlocks avail-

Continued on page 134

Circle 151 ➡

NOW.... even more efficient!



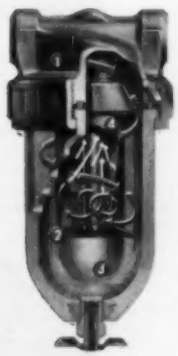
Watts "TORNADO ACTION" filter with new Automatic Drain

Designers — and users — of air-operated tools and equipment specify Watts filters because their superior filtering action and moisture-removing qualities have proved their efficiency. Now, with Watts' new automatic drain, you can have *truly automatic* filtering, too.

Watts "HIGH EFFICIENCY" filters remove condensate from air lines so effectively that draining of the bowl, in some instances, becomes necessary as many as three times daily. To meet the demand for labor-saving components, Watts has designed the "Auto Drain", a completely automatic drain filter which incorporates all the features found in the standard Series 602, 603 filters.

By use of the pilot principle, efficient and dependable removal of foreign particles and liquid condensate is attained. When liquid rises, the float admits air to the pilot valve chamber, opening a scavenger valve and allowing the trapped liquid and impurities to be blown out the drain opening.

Available in full range of sizes; ¼" through 1". Transparent bowls for pressures up to 150 PSI; metal bowls for pressures to 250 PSI.



How Watts "Tornado Action" removes condensate and dirt from air lines

Curved inlet ❶ directs incoming air in downward helical pattern. Larger impurities and condensate are "thrown out" by centrifugal action, collecting on bowl sides and spiraling downward past baffle ❷ into quiet chamber for draining-off. Baffle traps sediment in quiet chamber ❸ and allows only dry air centrifugally cleaned of larger impurities to reach filter element ❹ where finer particles are filtered out.

WATTS

FILTERS • REGULATORS • LUBRICATORS

YOUR SAFE SPECIFICATION

WATTS REGULATOR COMPANY, 10 Embankment Road, Lawrence, Mass.

Write for free technical catalog:

Charts, diagrams, and performance data enable you to specify the correct Watts pneumatic equipment.

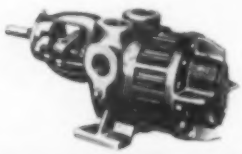
FOR YOUR PRODUCT OR YOUR PLANT

There's a Roper to Fit Your Needs

Series T .3 to 55 GPM
Choice of 192 Models

Pump and motor units . . . pump serves as end bell of motor. Require minimum space . . . easily installed . . . no coupling required . . . mount in any position. Each unit approximately same size as NEMA motor of HP required for driving. Open drip proof or totally enclosed motors; single or three phase as required.

ROPER
ROTARY PUMPS

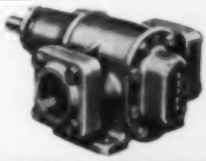


Series F 1 to 300 GPM
Pressures to 300 PSI

Feature helical steel pumping gears, hardened steel shafts, bronze flange-type bearings. 4-port design with 8 optional piping arrangements (4 for CW and 4 for CCW rotation) solves installation problems. With or without built-in relief valve in either mechanical seal or packed box construction.

ROPER
ROTARY PUMPS

Series K ¾ to 50 GPM
Pressures to 150 PSI



Extremely compact in all sizes. Helical pumping gears are hardened steel, with steel shafts and bronze bearings. Sizes 10 through 50 GPM have patented venturi suction and discharge principle for smooth flow and quiet operation. With or without built-in relief valve; packed box or mechanical seal.

ROPER
ROTARY PUMPS

Series H 5 to 75 GPM
Pressures to 1000 PSI

Designed to operate at direct motor speeds. Used for all types of hydraulic mechanisms where high pressures are required. Hardened steel spur gears for maximum efficiency, and heavy duty roller bearings and bronze wear plates for long life service. Mechanical seal or packed box.

ROPER
ROTARY PUMPS

Series 3600 40 to 300 GPM
Pressures to 100 PSI

Handle thick or thin liquids at slow speeds. Operate in either direction. Hardened iron pumping gears, hardened steel shafts, heavy duty bronze sleeve bearings. Mechanical seal or packed box. Series includes tank truck pumps as well as single motor driven units with gear reduction.

ROPER
ROTARY PUMPS

See Our Catalog in Sweets'
Send for "How to Solve Pumping Problems"

Roper Hydraulics, Inc. Dept. 711, P.O. Box 269 Commerce, Georgia
Manufacturers of Standard, Special and Custom Pumps for All Industries

Circle **124** *on Time-Saver Card*

NEW PRODUCTS

able. For a-c or d-c operation. Needs no more panel space than single snap switch model.

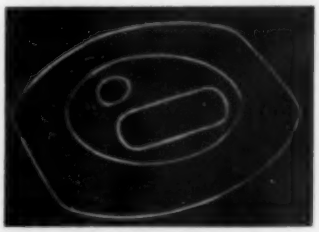
Specifications: Timing range adjustable from .2 sec. to 3 min., with repeat accuracy of ±10%.

Square D Co.
Milwaukee, Wisc.
Circle **315** *on Time-Saver Card*

PRESSURIZED METAL TUBE RING
. . . for extra heavy duty

Designation: GHS Willis-Hermatic Gaseals

Features: Hollow metal rings of tubular section containing inert gas under pressure, normally about 600 psi for the average metal- to-metal joint. With extremely high

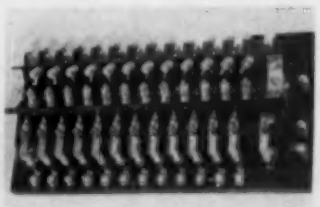


pressures, two or more rings can be used. Distortion from undue compression is avoided by housing the ring in joint recess.

Specifications: Withstands pressures to 20,000 psi, temperatures above 1000 F. OD from ⅛" to 96". Made of mild steel, stainless steel, cupro-nickel, monel, or copper alloy.

General Hermetic Sealing Corp.
Valley Stream, L.I., N.Y.
Circle **316** *on Time-Saver Card*

25-AMPERE, A-C RELAYS
. . . up to 24 poles



Features: Increased number of poles permits wider utilization as primary relay device controlling

Continued on page 136

Aeroquip PUSH-PULL Hydraulic Couplings Connect and Disconnect Fluid-Carrying Lines

QUICKLY and EASILY

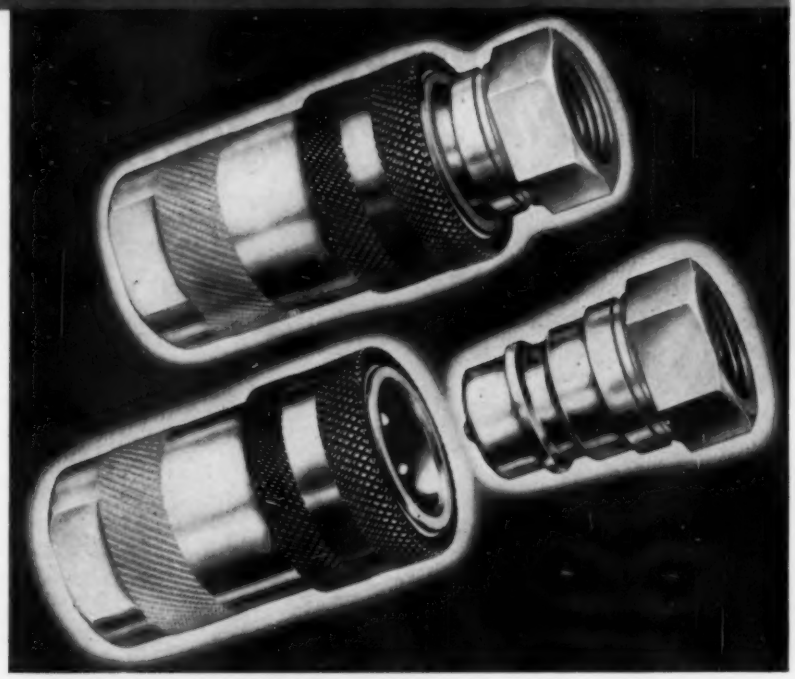
AVAILABLE IN TWO THREAD TYPES FOR INDUSTRIAL APPLICATIONS

5600 Series

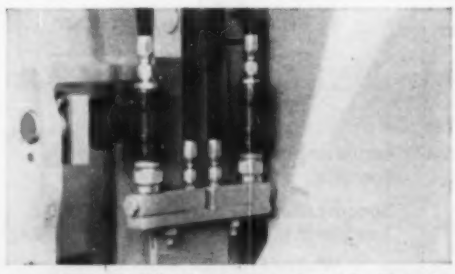
For N.P.T.F. pipe thread connection in ¼" ⅜", ½", ¾" and 1" sizes.

5606 Series

For all S.A.E. straight thread boss (O-ring seal) connections up through 1" tube sizes.



- **Quick Connection and Disconnection**
- **Positive Sealing—Connected or Disconnected**
- **Full Flow With Negligible Pressure Drop**
- **For Working Pressures Up to 3000 psi.**
- **Simple, Rugged Components**



Aeroquip PUSH-PULL Couplings on hydraulic lift truck.

The new Aeroquip PUSH-PULL Coupling is designed for quick, easy connection of hydraulic lines. It features a simplified poppet valve seal that gives long, leakproof service life. The coupling is constructed to protect against entry of dirt into the hydraulic system. Where connect-under-pressure feature is desirable, the 5650 Series PUSH-PULL Coupling is available.

Complete design information on the Aeroquip PUSH-PULL Coupling series is available. Fill in and mail the coupon below for your copy.

PUSH-PULL is an Aeroquip Trademark

Aeroquip

AEROQUIP CORPORATION, JACKSON, MICHIGAN

Aeroquip Corporation, Jackson, Michigan AH-11

Please send me your bulletin on PUSH-PULL Hydraulic Couplings for industrial applications.

Name _____

Title _____

Company _____

Address _____

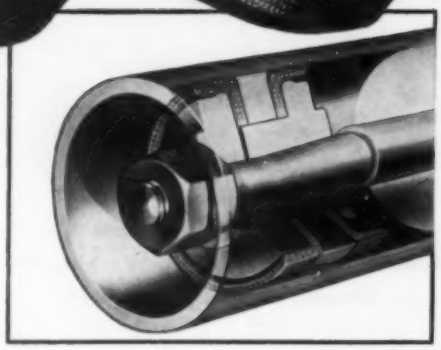
City _____ Zone ____ State _____

PUMPCUP ADVANTAGES

now yours for

- **HYDRAULIC CONTROLS**
- **AIR CYLINDERS**
- **RECIPROCATING PUMPS**

Two common Pumcup types: conventional and 45° bevel type . . . available in a complete range of sizes and texture-engineered compositions.



Cutaway view of typical Pumcup installation resulting in prolonged high efficiency.

TAKE it from experienced users, Darcova Pumcups offer payoff advantages that can't be equalled! For example, they last many times as long as ordinary piston packing..and they *hold peak efficiency* from start to finish. Because of the resulting production and maintenance economies, plant after plant is standardizing on Pumcups.

Improved application of the cup principle does the trick. And Darcova Pumcups are *texture-engineered* in *a range of compositions* to meet most temperature-pressure-fluid conditions. And they are available in sizes and types exactly right for your particular equipment.

It will pay you to get *all* the facts. Just ask for Pumcup Bulletin No. 5903.

DARLING VALVE & MANUFACTURING CO.
Williamsport 15, Pa.

DARCOVA THE ORIGINAL COMPOSITION CUP
TRADE MARK
PUMCUPS

Circle **42** on *Time-Saver Card*

NEW PRODUCTS

contactors, solenoid valves, etc. Control stations make, but do not break, current. Control contacts on relays interrupt current. Mechanically held relays use power surge to open and close contacts.

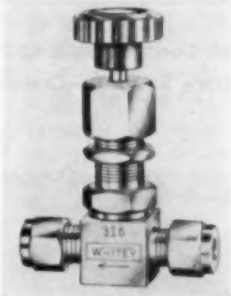
Specifications: Standard control voltages: 24, 110 to 220, 208 to 240, 25, 50 or 60 cycles, and 550 volts, 60 cycles. Panels: front connected, flush dead back, ebony asbestos. NEMA 1 enclosure for surface mounting. Enclosed ratings continuous, same as open type. Rated 25 amps per pole for non-inductive loads on alternating current. Electrical spacings adequate for 600 volts. Rated for inductive loads.

Automatic Switch Co.
Florham Park, N.J.
Circle **317** *on Time-Saver Card*

SMALL VALVES
. . . from 1/8" to 1/2"

Designation: Whitey Micro

Features: Regulating needle and fingertip control valves for processing viscous and volatile liquids, and for gases at both temperature



extremes, pressure, vacuum, and corrosion conditions.

Specifications: Furnished in stainless steel, monel, and hastelloy.

Whitey Research Tool Co.
Oakland, Calif.
Circle **318** *on Time-Saver Card*

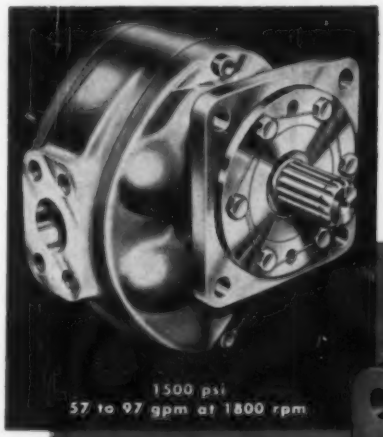
LINE CLAMP
. . . has hinge

Designation: Flip-loc, TA5000 Series

Features: Quick-action line clamp opens and closes indefinitely without distortion. Hinge is built into parent metal. Quick disconnect nut

Continued on page 138

NOW • Added Service Life for the Accepted Leader Among Heavy Duty Fluid Power Pumps



HYDRECO®

Series 3000K FLUID POWER PUMPS

MAIN SHAFT BEARINGS
Large, heavy-duty, anti-friction roller bearings have more than adequate capacity to carry full pressure loads at high speeds.
THRUST BEARINGS
Carry axial load of the drive shaft.
DOUBLE LIP SEAL
Protects high pressure seal and keeps dirt out of the pump.
HIGH PRESSURE ROTARY SEAL
Eliminates pressure bleed back, keeps pump efficiency high.
PRESSURE-BALANCED WEAR PLATES
Balanced, hydraulic forces on both sides of the plates accurately maintain fixed clearances between the plates and the gear faces . . . high volumetric efficiencies are assured at all pressures and power-robbing, frictional contacts eliminated.

APPLICATIONS

EARTH MOVING EQUIPMENT
CONSTRUCTION MACHINERY
MATERIALS HANDLING EQUIPMENT
AGRICULTURAL MACHINERY
MOBILE and GENERAL INDUSTRIAL EQUIPMENT

Member NFPA

The basic design of HYDRECO Fluid Power Pumps has been proven in thousands of successful installations . . . on Earth Moving, Materials Handling and Agricultural equipment . . . where dependability, efficiency and ruggedness are of prime consideration. *Now,* this famous design has been refined by improvements that give you this outstanding performance PLUS – *substantially extended service life – three times greater!* Translated in terms of dollars and cents, this greater service life adds value to the Pumps you buy and pays your customers extra dividends on their investment.

Check the features shown above . . . combined, they enable HYDRECO Series 3000K Pumps to set new standards in performance, efficiency and trouble-free service.

Write–

for performance and installation data on HYDRECO 3000K Series Fluid Power Pumps.

HYDRECO DIVISION
THE NEW YORK AIR BRAKE COMPANY
KALAMAZOO • MICHIGAN

Hydreco Division
The New York Air Brake Company
9004-11 East Michigan
Kalamazoo, Mich.

Please send me complete information on HYDRECO Series 3000K Pumps.

Name_____
Company_____
Address_____
City_____ Zone____ State_____

IF IT ROTATES SEALOL CAN SEAL IT

for transferring

GASES-VAPORS
LIQUIDS
CRYOGENICS

TO 50 RPM

Pressures to 3,500 PSI
Temperatures to 350°F.

TYPE C SWIVEL JOINT

Precision-engineered and built for applications calling for low RPM's or oscillating motions. Special aircraft types meet or exceed Spec, MIL J-5513.

Current applications include atomic submarines, jet aircraft, coal mining and railroad track maintenance equipment.

TO 1,200 RPM

Steam pressures to 150 PSI
Fluid pressures to 350 PSI
Temperatures to 425°F.

TYPE L ROTARY JOINT

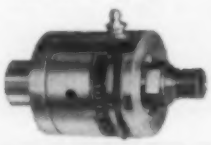
Balanced seal design reduces friction to the absolute minimum for low torque giving long, trouble-free life. Available with or without syphon pipe.

Current applications include textile, paper, plastic, and rubber plants.

TO 10,000 RPM

Pressures to 1,000 PSI
Temperatures to 150°F.

TYPE EL FLUID TRANSFER



New, high performance unit for transferring coolants and other fluids through a rotating, hollow spindle or shaft. Built to withstand rapid cycling pressures to 1,000 PSI such as those found in hydraulic and pneumatic chucks.

Current applications include deep hole and precision drilling conversions, turret lathes and chuckers.

SEALOL CORP.

1511 Post Road, Providence 5, R. I.

Circle **128** *on Time-Saver Card*

NEW PRODUCTS

disengages with 1¼ turns on integrated bolt head. No need to remove clamp from fixed mount.

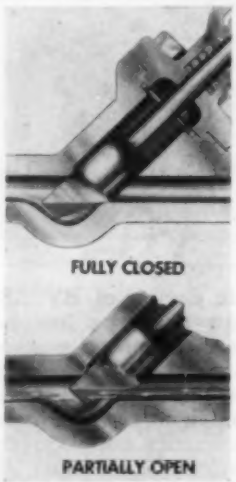
Specifications: Sizes from ¼" to 6" diameter. Formed of 321 stainless steel. Cushioning materials: asbestos-teflon, neoprene rubber, AW aromatic fuel and weather-resistant cushion, and corrugated stainless.

TA Mfg. Corp.
Los Angeles, Calif.

Circle **319** *on Time-Saver Card*

STRAIGHT-FLOW CONTROL VALVE
. . . has low friction loss

Features: Flow moves through valve in unrestricted straight line at all throttling positions. Raise or lower stem to regulate flow. Stem is at selected angle to flow (45 deg. shown). Flow passes through 90-deg., milled V-groove in stem tip. Stem is fully stabilized at all throttling positions, eliminating tip vibration. Passes more fluid for a given pressure with less turbulence. Pressure drop and friction loss reduced. Infinitely variable throttling.



Specifications: K factor is .35. Pressure ratings from 600 to 10,000 psi. Sizes from ⅛" to 4". Any packing style available. Automatic control in diaphragm or cylinder actuator. Special soft seat style available. Calibration plate indicates orifice opening.

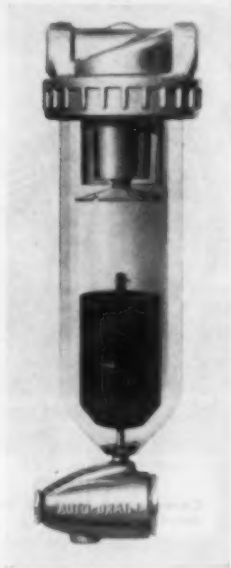
General-American Valve Co.
Corona del Mar, Calif.

Circle **320** *on Time-Saver Card*

AIR LINE FILTER
. . . drains automatically

Designation: Auto Drain

Features: Filter uses pilot principle, incorporates float which admits air to pilot valve chamber when liquid accumulates. Scavenger valve opens, then trapped liquid and impurities are blown out drain opening.



Specifications: Sizes from ¼" to 1". Transparent plastic bowls for pressures to 150 psi; metal bowls for pressures to 250 psi.

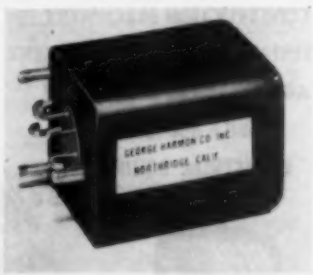
Watts Regulator Co.
Industrial Division
Lawrence, Mass.

Circle **321** *on Time-Saver Card*

TIME DELAY RELAY
. . . has solid state components

Designation: Models EL 101, EL 102

Features: Use of solid state components eliminates problems of cycling and repeatability, and temperature and mechanical limitations. Light-weight, small. Not limited to low ranges.



Specifications: Six models give

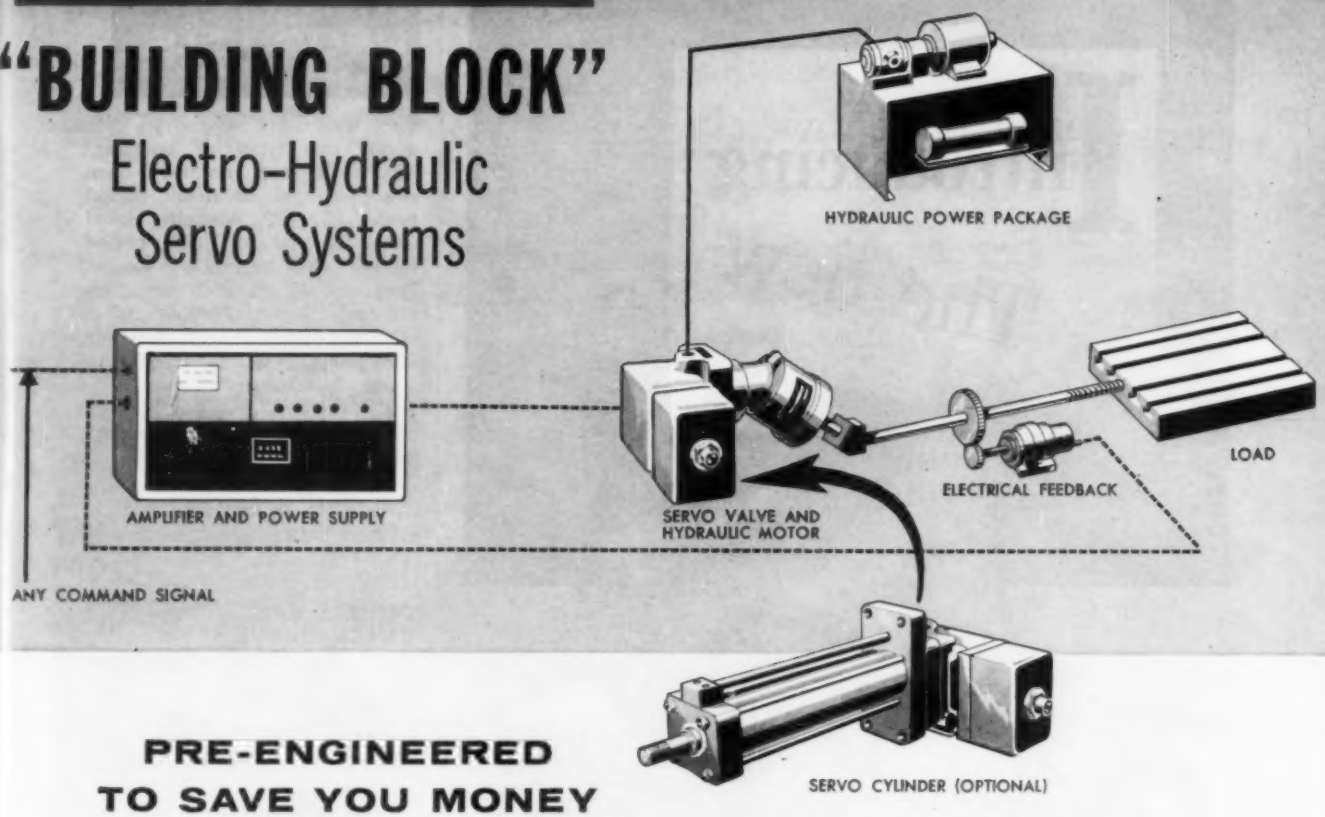
Continued on page 140

Circle 147 ➡

A NEW CONCEPT

"BUILDING BLOCK"

Electro-Hydraulic Servo Systems



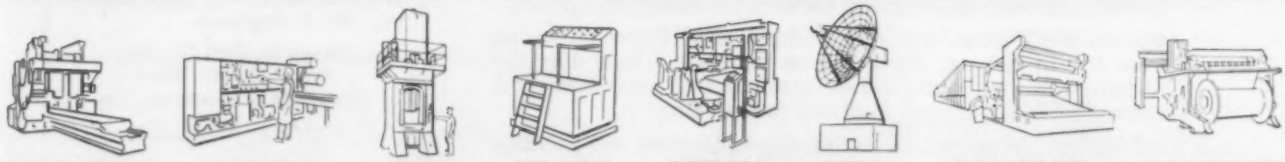
PRE-ENGINEERED TO SAVE YOU MONEY

Standard hydraulic and electrical components are now pre-engineered into a series of complete and dependable Electro-Hydraulic Servo Systems. Vickers has the most extensive line of individual "building block" components available for such systems. Inherent "trim flexibility" makes possible systems which will satisfy a very wide range of application . . . at only a fraction of the cost usually incurred in specially engineered systems. A very substantial saving in lead time is now possible.

Vickers "Building Block" Closed Loop Servo Systems have proved their merit on machine tools, fabricating machines and processing equipment. The amplifier is precisely matched to the servo valve torque motor. The work load requirement is continuously monitored by electrical feedback devices to insure that directions (command signals) are accurately followed at all times.

Positional accuracy of better than .001 is obtainable with a hydraulic motor and lead screw. In many position applications, cylinders can be used with similar accuracies. Velocity can be maintained within one or two rpm. In addition to position and velocity controls now in service, constant horsepower and constant tension systems soon will be available. Any command signal may be used with these systems . . . from a simple potentiometer to complete numerical control. For further information, ask for Engneering Bulletin No. 59-75.

wide range of applications



CUTTING MACHINERY · FOOD PROCESSING · FORMING MACHINERY · TEST STANDS · FABRICATING · ANTENNA DRIVES · PAPER MACHINERY · TEXTILE MACHINERY

VICKERS INCORPORATED
DIVISION OF SPERRY RAND CORPORATION
Machinery Hydraulics Division
ADMINISTRATIVE and ENGINEERING CENTER
Department 1474 • Detroit 32, Michigan

Application Engineering Offices: ATLANTA • CHICAGO* • CINCINNATI • CLEVELAND DETROIT* • GRAND RAPIDS • HOUSTON • INDIANAPOLIS • LOS ANGELES AREA (El Segundo)* • MILWAUKEE • NEW YORK AREA (Springfield, N.J.)* • PHILADELPHIA AREA (Media) • PITTSBURGH AREA (Mt. Lebanon) • ROCHESTER • ROCKFORD SAN FRANCISCO AREA (Berkeley) • SEATTLE* • ST. LOUIS • WORCESTER
Factories also in: Australia, England, Japan and Germany • In Canada: Vickers-Sperry of Canada, Ltd., Toronto*, Montreal and Vancouver
Field Service Headquarters Underlined. Whse. Stock & Repair Branches*.

8356

ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

Pathon Series WAL...WHL

AIR AND LOW PRESSURE HYDRAULIC

Cylinders

You can improve the durability and appearance of your equipment with the new Pathon W Series Air and Low Pressure Hydraulic Cylinders.

Valuable space can be saved with these proven screw thread head units. They are available in all standard mounting types plus the type 8, intermediate flange mount (illustrated above) in bore sizes from 1⅛" thru 6".

Specify WAL for air or WHL for oil service to 200 psi. These economical units incorporate non ferrous barrels, hard chrome plated rods, and "U" cup rod packing for minimum friction.

Specify WAT for air service to 250 psi; or WHT for oil service from 350 to 500 psi, depending on bore size. These units incorporate hard chrome plated steel barrels, case hardened, chrome plated rods, and multi-lip rod packing.

All Pathon cylinders have externally replaceable rod packing.

Write for Bulletin #25

Pathon MANUFACTURING COMPANY

3823 PACIFIC AVE. • CINCINNATI 12, OHIO

A-59

FLUID OPERATED AND CONTROL EQUIPMENT

Circle **112** *on Time-Saver Card*

NEW PRODUCTS

three time delay ranges and tolerances, two types of operation. Model EL 101, normally open, closes at end of delay period; model EL 102, normally closed, opens at end of delay period. Ranges and tolerances: General Purpose, .05 to 950 sec., 20% accuracy; Special Purpose, .05 to 90 sec., 10% accuracy; Precision, .30 to 60 sec., 5% accuracy. Weighs 4 oz. Measures 1½" x 1⅛" x 1⅝". Standard operating voltages 24-31 v. dc. Standard contact, resistive load, 2 amps.

George Harmon Co., Inc.
Northridge, Calif
Circle **322** *on Time-Saver Card*

DOUBLE BALL, CHECK VALVE . . . is miniature

Designation: #9061

Features: Separate ball for each inlet. If both supply pressures fail,

both inlets are immediately sealed. No bleed-off of downstream pressure. High pressure of one inlet shuts off low pressure of alternate inlet until alternate inlet pressure becomes higher.

Specifications: Body rated for 100 psi, 300 F maximum.

George W. Dahl Co., Inc.
Bristol, Rhode Island
Circle **323** *on Time-Saver Card*

AIR COMPRESSORS . . . are tank mounted

Features: Automatic pressure switch with loadless starting, built-in air filter and silencer, automotive type pistons, honed alloy cylinders, extra heavy crankshaft,

Continued on page 142

PROBLEM: *Which fire-resistant fluid is best for your particular operation?*

SOLUTION: *Ask the only manufacturer who makes all three!*

HOUGHTO-SAFE 600 SERIES
(*Water-Glycol Fluids*)
Adequate for 85% of all hydraulic systems; provides maximum fire protection with good lubricity for systems running below 150°F. temperatures.

HOUGHTO-SAFE 1000 SERIES
(*Phosphate-Ester Fluids*)
Available in three viscosities for systems running as hot as 150°F. and where maximum lubricity is needed for heavy bearing loads.

HOUGHTO-SAFE 5040 SERIES
(*Water-Oil Emulsion Fluids*)
Lower cost, fire-resistant fluids that are stable, afford good lubricity and provide adequate fire protection where hazards are intermittent or remote.

Selecting the *right* hydraulic fluid depends upon operating pressures and temperatures, pump and equipment design, degree of fire hazard, and other important factors. But to make sure you get a completely unbiased recommendation —call in the only manufacturer who makes all types.

Houghto-Safe fire-resistant fluids have proved themselves in industry's toughest hydraulic applications—not only as life and property-savers, but as efficient protection against excessive pump and packings wear. Houghto-Safe is also used extensively by the U. S. Navy for such critical carrier applications as deck-edge elevators and catapults.

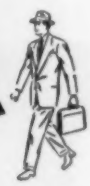
For a completely unbiased recommendation of the best and most economical fluid for your equipment and degree of fire hazard, call in your Houghton representative. Or write E. F. Houghton & Co., 303 W. Lehigh Ave., Phila. 33, Pa.

HOUGHTO-SAFE HYDRAULIC FLUIDS

... products of

E. F. HOUGHTON & CO.

PHILADELPHIA • CHICAGO • DETROIT • SAN FRANCISCO • TORONTO



Ready to give you on-the-job service

all STEEL

New Fulflo all-steel, piston type, oil relief hydraulic by-pass valves combine proven features with the advantages of all-steel construction in flange models from 1" to 2".

FULFLO

ALL-STEEL, ALL-BRASS OR OTHER COMBINATIONS FOR POSITIVE AUTOMATIC PRESSURE CONTROL YOU CAN DEPEND UPON AT ALL TIMES

all BRASS

Fulflo Valves feature shear-closing action for quiet, non-chattering operation. They offer greatest safety, matched to job conditions. Priced right for O.E.M. use . . . built right for superior replacement service.

• Standard and flanged models • Just 6 springs for pressures to 500# • Steel, cast iron or brass bodies • Brass, steel or stainless pistons • Pipe sizes to 3"
• Specials to your requirements

FREE, completely NEW CATALOG . . . just off the press!

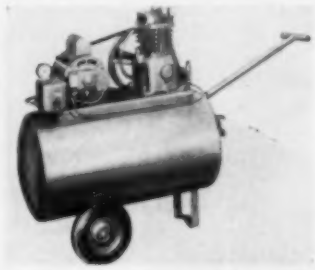
THE FULFLO SPECIALTIES CO., INC.
415 Fancy Ave.—Blanchester, Ohio

Circle **60** *on Time-Saver Card*

NEW PRODUCTS

fan type pulley, visible or dip type oil check, ASME air receivers.

Specifications: 110/220-volt, 60-cycle, 1750-rpm motors on ½ and ¾-hp models; 220-volt, 60-cycle,



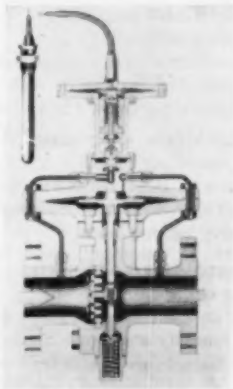
1750-rpm motors on 1½-hp models. Wheel-mounted, portable or stationary models available in ½ and ¾ hp; stationary models in 1½ hp.

National Compressor Corp.
Chicago, Ill.

Circle **324** *on Time-Saver Card*

TEMPERATURE CONTROL VALVE . . . is pilot operated

Features: Valve has integral pilot with filter screen, oversize clog-resistant passages. Short stroke, linear flow curve. Self-lapping,



self-cleaning metal seats. Metal diaphragms. Employs sliding gate and plate main valve.

Specifications: Sizes: 2½", 3". Ten ranges control temperatures from 35 F to 450 F. For pressures to 250 psi, temperatures to 406 F. Cast-iron flanged bodies, with 125-psi or 250-psi ASA connections.

OPW-Jordan
Cincinnati, Ohio.

Circle **325** *on Time-Saver Card*

Continued on page 144

HYDRAULIC ENGINEERING

FOR INDUSTRY

CARDWELL

TRADEMARK SINCE 1829

DESIGN SERVICES
FABRICATION
POWER UNITS
HYDRAULIC PANELS
ELECTRICAL CONTROL PANELS
ACCUMULATORS
STOCKING DISTRIBUTORS
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Complete Engineering and Design Services Are Available. Qualified Sales and Service Engineers in Most Areas.

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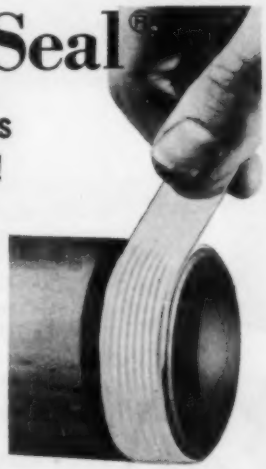
Quality — A CARDWELL TRADITION SINCE 1829

Franklin at 19th St., Richmond 11, Virginia • Phone Milton 4-4593

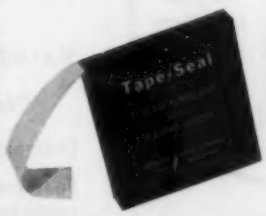
new Tape-Seal®

seals hydraulic fittings 7 ways better, faster!



Not just another sealing compound! Tape-Seal, made from Du Pont's miracle Teflon®, *wraps* around connection . . . gives you these 7 important advantages:

Faster, easier to apply . . . wrap around connection, tear off, that's all ■ Never hardens . . . disassemble with ease, anytime ■ Completely insoluble and inert to chemicals, alkalies, and acids ■ Seals both threaded and flared joints. Ideal for packing ■ Unaffected by temperatures −250° to +500° F ■ Lubricates as it seals . . . completely eliminates thread-galling even on stainless steel ■ Withstands high pressures and vibration ■ In widths of ½", ¾", 1", 4" and wider.



▶ Send for free sample!

FRIESLAND PLASTICS COMPANY
Friesland, Wisconsin

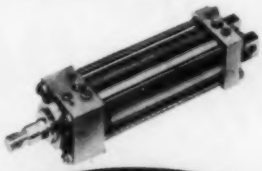
WHO'S SMILING?

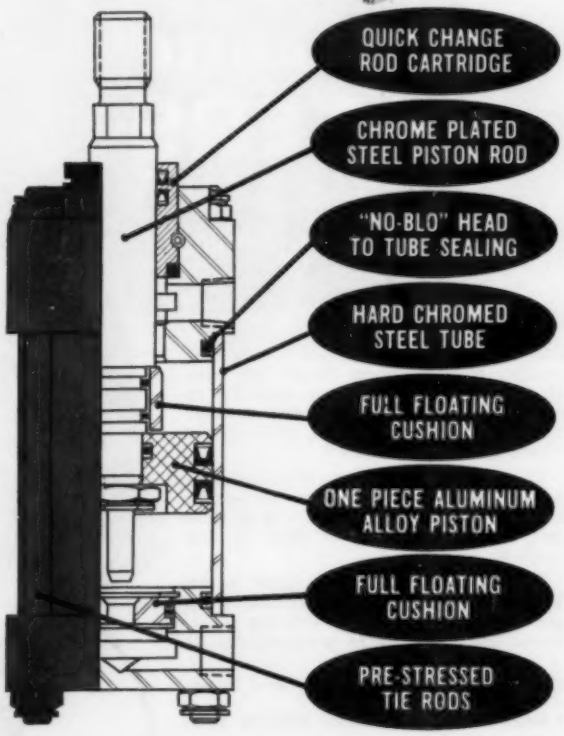
YOU, WHEN YOU DISCOVER THE DESIGN ADVANTAGES OF . . . .

LINDBERG

SQUAREHEAD CYLINDERS

DESIGN IN LINDBERG AND . . . ADD ALL THESE FEATURES! and many more besides!




QUICK CHANGE ROD CARTRIDGE
CHROME PLATED STEEL PISTON ROD
"NO-BLO" HEAD TO TUBE SEALING
HARD CHROMED STEEL TUBE
FULL FLOATING CUSHION
ONE PIECE ALUMINUM ALLOY PISTON
FULL FLOATING CUSHION
PRE-STRESSED TIE RODS

CERTAINLY! Your choice of mounting styles • 7 bore sizes to 6" • Built to JIC recommendations • Standardized mounting dimensions.

WANT TO SMILE AGAIN!

FOR DETAILS OF THESE AND MANY OTHER FEATURES, WRITE FOR THESE BULLETINS TODAY.

SQUAREHEAD "S" LINE—	BULLETIN S-101
2000 PSI "H" LINE—	BULLETIN H-101
HEAVY DUTY "A" LINE—	BULLETIN A-101

for fast action on "specials" tell us what you need.

LINDBERG AIR and HYDRAULIC DIV.

TEER-WICKWIRE & CO.

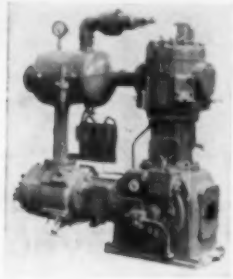
1802 WILDWOOD AVE. • JACKSON, MICHIGAN

NEW PRODUCTS

BOOSTER COMPRESSORS
. . . 45-psi minimum intake

Designation: AG 1-2, AG 1-1

Features: Air-cooled, double-acting, single-stage. Can supply 100-psi air to high performance rock drills in drifting and development work in coal mines served by low pressure air plants. AG 1-2 patterned after heavy-duty AR-1 compressor. Booster unit's cylinders are smaller, work in parallel. Has pulsation damper. Lower than normal discharge velocities, low air temperatures. AG 1-1 has single cylinder, no pulsation damper. Automatic safety devices operate when pressure on suction sides drops below pre-set minimums.



Specifications: Compressors deliver 590 to 1180 cfm through long lines at 100 psi. Weight: AG 1-2 2800 lbs.; AG 1-1 2300 lbs. 730 rpm. AG 1-2 dimensions approx. 5′ x 5′ x 3′.

Atlas Copco
New York, N.Y.
Circle **326** *on Time-Saver Card*

Capital

HYDRAULIC FILTERS

for Hydraulic and Oil Re-circulating Machinery

Capital Hydraulic Filter Units are smaller than ordinary filters but with filtering capacity equal or superior to many larger filters. Small size permits greater latitude in design, particularly where space is restricted.

Capital Filter Units are designed with one-piece construction — no screws or nuts to work loose and be lost or mislaid. Simple and easy to clean by any method.

Made from specially designed woven Monel wire, with narrow corrugations presenting the greatest filtering area. Monel support supplies extra sturdiness.

Capital Filter Units are made in 4 Types:

- **MONO-BILT 60 Mesh All Stainless Steel (Sump type).**
- **MONO-BILT Standard All Stainless Steel**
- **MONO-ECONO Mono-Bilt with Monel Metal Insert and Cadmium Plated Top and Bottom.**
- **LINE TYPE with Aluminum Housing and Mono-Bilt, one Piece Filter Unit.**

Capital Line Type Filter

Built from Monel Metal they are impervious to rust and corrosion.

CAPITAL ENGINEERING & MFG. CORP.

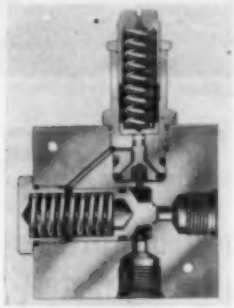
5836 SOUTH ASHLAND AVENUE, CHICAGO 36, ILLINOIS

Circle **29** *on Time-Saver Card*

GAS RELIEF VALVE
. . . has positive seal

Features: Seating force increases as pressure rises. Since cracking, re-seat, and full-flow pressures are close, valve opens quietly, operates without chatter. Soft metal seat.

Specifications: Standard connections: internal straight thread



(O-ring seal), ¼″ to ⅝″; internal pipe threads, ⅜″ to ½″; U.S. Bureau of Standards high pressure tube, ⅜″ and 9/16″. Stainless steel body and internal parts. Pressures from 1000 to 7000 psi. Temperature range: −65 F to 160 F standard, higher on application.

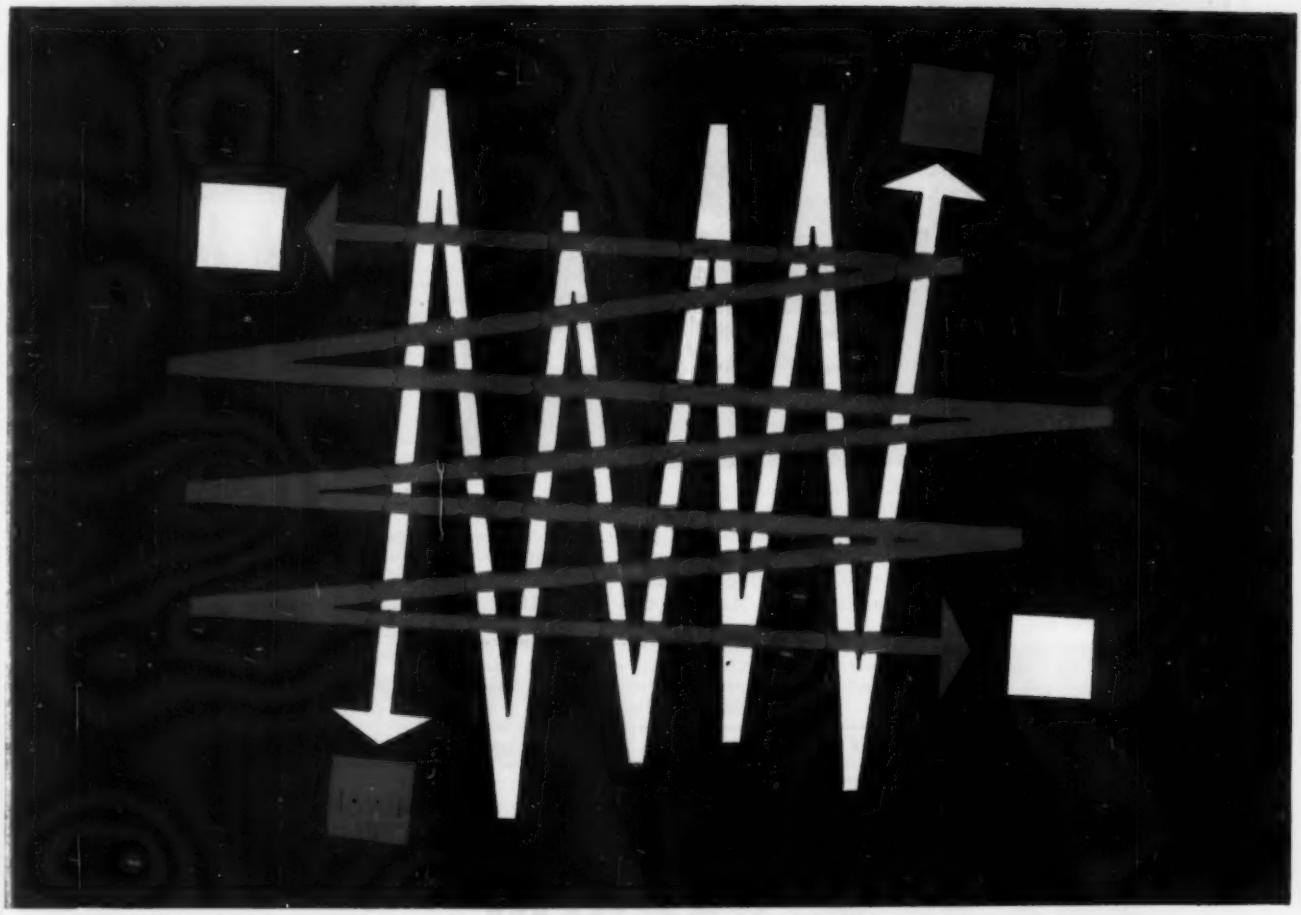
Republic Manufacturing Co.
Cleveland, Ohio
Circle **327** *on Time-Saver Card*

VALVE
. . . lets operator "feel" hydraulic pressure

Designation: Type 4879

Features: Designed for mechanisms requiring constant manual control. Increased movement of control gives corresponding increase in hydraulic pressure, providing progressive braking or declutching.

Continued on page 146



LINEAR MOVEMENT precise and controlled,

powerful or gentle, cushioned or abrupt, fast or slow,

variable or constant, can only

be achieved by hydraulics.

Ask us at KEELAVITE

We at Keelavite are a team of experts engaged SOLELY in the application of hydraulic power

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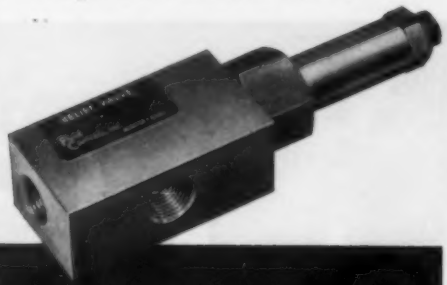
Hydraulics

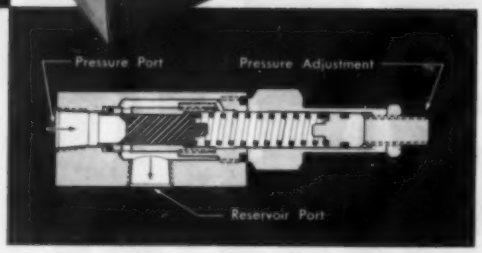
KEELAVITE HYDRAULICS LTD · ALLESLEY · COVENTRY · ENGLAND · TEL: MERIDEN 441

Circle **55** on *Time-Saver Card*

Long Life—Dependable . . .

RELIEF VALVES
Guided Piston Type





- Designed for continuous operation
- Quiet
- Good low pressure regulation
- Fast response
- Hardened parts

Write for detailed information.

SPECIFICATIONS:
- For oil • Flows: to 20 gpm
- Adj. Ranges: 0 to 30 psi • 0 to 75 psi 0 to 150 psi • 0 to 200 psi • 0 to 250 psi 0 to 300 psi • 0 to 600 psi
- Pipe Sizes: ¼", ⅜", ½" and ¾" NPTF

Fluid Controls, inc.
Member of National Fluid Power Association

Manufacturers of Hydraulic Valves and Devices
Relief Valves • Check Valves • Restrictor Valves
Needle Valves • Pilot Check Valves • Special Valves
Pressure Compensated Flow Regulators

1284 N. CENTER STREET • MENTOR, OHIO

A HANDFUL OF POWER

DOWTY Pressure Balanced
HYDRAULIC GEAR PUMPS

Pressures to 2500 PSI • Outputs from 1/2-60 GPM

Shown here is our Model GP2-85 which will deliver 18 GPM at pressures to 2000 PSI. Volumetric efficiency exceeds 95% throughout the operating range. Fully pressurized lubrication independent of discharge pressure. 14 other sizes available.

Berry Hydraulics
A Division of Oliver Tyrone Corp.

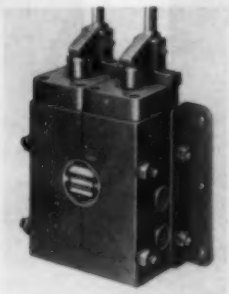
MAIL FOR COMPLETE DATA
Berry Hydraulics
2227 Oliver Building
Pittsburgh 22, Pa.

Name _____
Company _____
Address _____
_____

Circle **28** on *Time-Saver Card*

NEW PRODUCTS

Movement of control lever produces resistance proportional to hydraulic actuator. Gives operator more control than conventional valves.



Specifications: Input pressures 0-500 psi, 0-1200 psi, 0-1500 psi. All port sizes ⅜" BSP. Valves supplied singly or in multiples to six. Can be adapted for foot operation.

Keelavite Hydraulics Ltd.
Allesley, England
Circle **328** on *Time-Saver Card*

AUTOMATIC VALVE CYCLING TESTER
. . . controls and reads

Designation: Model 1064

Features: For evaluation and development testing. Controls opening and closing speed. Controls and reads opening and closing torque

with provisions for recording equipment. Limits travel in either direction. Counts actuations. Can pressurize valve under test with complete operator and system protection.

Specifications: Accomodates valves from ⅛" to 1½". Torque capability to 300 lb. in. 115 v. ac., 60 cycle. Measures 54" x 32" x 40".

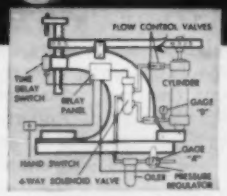
WesTEC, Inc.
Compton, Calif.
Circle **329** on *Time-Saver Card*

Circle **15** on Time-Saver Card

PNEU-TROL

AUTOMATION TIME DELAY SWITCH

FOR CONTROLLED TIME DWELL OF AIR OR HYDRAULIC CYLINDERS



Arbor press converted to high production power press, using double end cylinder, Time Delay Switch, Flow Control Valves, and related equipment. Flow Valves permit independent ram speed adjustment in both directions. Differential pressure between "A" and "B" gages caused by throttling effect of Flow Control Valve creates time interval in working pressure build-up, which is compensated for by Time Delay Switch setting. This insures consistently accurate working pressure on the ram.

- **Holds dwell accurately to fraction of second**
- **Automatically re-sets**
- **Designed for millions of actuations**

Pneu-Trol Time Delay Switch will hold any cylinder controlled motion or operation at a positive stop on either end of the stroke for ¼ to 60 seconds in 20 to 1 ratios. Simple, easy to adjust. Automatically re-sets after each actuation. Positive, controlled time dwell permits wider use of air or hydraulic power in automatic operations, increases accuracy of work by insuring split-second accuracy of time dwell. Available with many thrust linkages for left and right, down, up, or horizontal thrust. Write for Special Bulletin TDS-59

AUTO-PNEUMATIC COMPONENTS INC.
2919 GRANT STREET
BELLWOOD (Chicago Suburb) ILLINOIS

Circle **141** on Time-Saver Card

Saves hours in piping installations

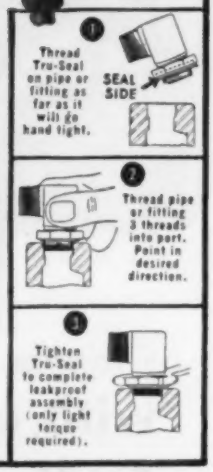
PAT. PENDING

Eliminates leaks in oil, air, water, vacuum, chemical lines

Tru-Seal saves hours in assembling piping installations because it enables you to run your pipe lines in any direction you wish, quickly and easily—without having to recut and re-thread piping sections. Wherever used on air, oil, water, steam, vacuum or chemical lines, it seals perfectly at —100° F. to plus 500° F.—*without the use of pipe dope.* Its installation requires only light tightening torque, thus eliminating over-tightening damage to valves, pumps, compressors, and other fittings.

For further information write

TRU-SEAL DIVISION
FLICK-REEDY CORPORATION
7N017 York Rd., Bensenville, Ill.
"Miller Fluid Power" is also a Div. of Flick-Reedy Corp.


1
Thread Tru-Seal on pipe or fitting as far as it will go hand tight.
SEAL SIDE
2
Thread pipe or fitting 3 threads into port. Point in desired direction.
3
Tighten Tru-Seal to complete leakproof assembly (only light torque required).

Standard *For* Industry

CENTURY Liquid Level SIGHT GAGES

- **Easiest Possible Installation on any wall thickness**
- **Large Face for Better Visibility—7″ Overall**
- **Can be used with non-inflammable oil**
- **Leak-Proof — No Dripping**
- **For Better Service at Lower Costs, Start Using Century Gages Today**
- **Available Immediately — from STOCK**

Send for new catalog containing dimensional information on hydraulic reservoirs and complete line of power unit accessories.

CENTURY HYDRAULICS

Division of CENTURY-DETROIT
7701 LYNDON AVE. • DETROIT 38, MICH.
Telephone: Diamond 1-3797

Circle **32** on Time-Saver Card

A seal is only as good as its performance

HADBAR O-Rings have durability...

Where it counts!

Almost any O-Ring will function under ordinary conditions . . . but, to meet tough problems . . . temperature extremes, corrosion, high pressure in conveying chemicals, searching liquids, fuel oils, steam or hydraulic . . . applications, specify the HADBAR 1000-80 O-Ring.

Molded of a high modulus, fuel resistant fluorosilicone rubber compound the HADBAR O-Ring contains no plasticizers, retains low temperature flexibility even after long periods of immersion in fuels, and is not affected by ozone and weather.

HADBAR also custom molds and extrudes this rugged proprietary compound into seals, clamps, diaphragms and other products for a wide variety of applications in many critical areas of advanced design fuel, lubricant and hydraulic systems. It may be the answer to your problem . . . get in touch with us . . . we have the skills and facilities to help you.

HADBAR INC.

9530 GIDLEY ST., ROSEMEAD, CALIFORNIA, CUmberland 3-4121

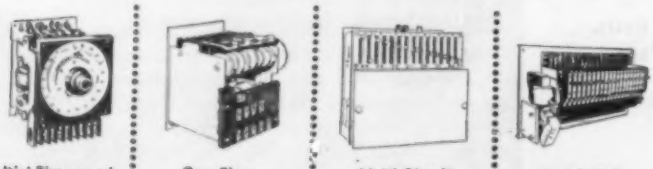
Circle **70** on Time-Saver Card

with easy-to-use *EAGLE* CYCL-FLEX reset timers

A highly accurate and dependable easy-to-use timer, designed for mounting in control panels. Sealed dial protects timer when exposed to oil and dust conditions. Timer switches control four load circuits. Interlocking contacts are provided without the use of auxiliary relays. Synchronous motor drive insures accurate timing.

WRITE for descriptive Bulletin 120. Address Dept. AH-1159.

EAGLE HAS 24 TYPES TIME-COUNT CONTROLS



EAGLE SIGNAL COMPANY
A DIVISION OF THE GAMEWELL COMPANY
MOLINE, ILLINOIS

REPRESENTATIVES IN PRINCIPAL CITIES

Circle **49** on Time-Saver Card

USEFUL LITERATURE

Continued from page 64

SERVO VALVE

Electro-hydraulic 3 or 4-way servo valve is single-stage, spool type. Spool connects directly to permanent magnet, d-c torque motor. Spool motion is proportional to unbalanced current in motor coils. A few watts can control a multiple hp system. Steel valve body has hardened and lapped spool and sleeve assembly. Needs only 10-micron filtration. Mounts in any position. Rated at 6 gpm at 500-psi valve drop. Bulletin SS102 has specifications, installation drawings. *Hydraulic Controls Co., Inc., Newton, Mass.*

Circle **412** on Time-Saver Card

SHEET RUBBER

New price list covers Silicol silicone rubber sheets in thicknesses from 1/32" to 1/2", in areas of 12, 20, 24, and 30 inches square. Priced for quantities from 1 to 9 and 10-24. Quotations on other amounts available. Also available fiberglass reinforced, and low durometer, Silicol sheets. *Colonial Rubber Co., Ravenna, Ohio.*

Circle **413** on Time-Saver Card

STEEL ALLOY TUBING

Bulletin TB-430 discusses advantages of tubing vs. bar stock, particularly if an alloy steel is involved. Covers initial cost, structural advantages of tubing, fabrication by machining, types of steel, types of tubes, and procurement tips. *Tubular Products Division, Babcock & Wilcox Co., Beaver Falls, Pa.*

Circle **414** on Time-Saver Card

GEAR PUMPS

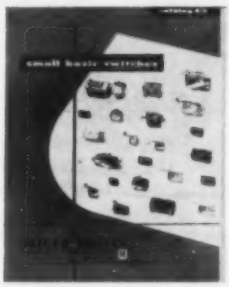
Pumps use pressure from outlet port to reduce clearance between bearing faces and gears. Rated capacities from 1.7 to 7.8 gpm at 2000 rpm. Displacement from 0.2 to 0.9 cu. in. per revolution. Operating pressure 2000 psi, operating speeds to 4000 rpm. Tin-aluminum bearings, double lip shaft seal, hardened and ground

steel gears and shafts, high-tensile aluminum bodies. *Wooster Div., Borg-Warner Corp., Wooster, Ohio.*

Circle **415** on Time-Saver Card

SMALL BASIC SWITCHES

Catalog 63 covers plastic cased switches with no additional enclosures or attachments. Includes miniature and sub-miniature switches, single-pole, double-throw, snap-action switches, and



twin-break units. Smallest switch is .350" x .500" x .200". Actuators also covered. Dimensions, drawings, photographs, specifications. 20 pages. *Micro Switch, Div. of Minneapolis-Honeywell Regulator Co., Freeport, Ill.*

Circle **416** on Time-Saver Card

FREE-PISTON PUMP

Three cylinders operate in sequence. When #1 is discharging (compressed air is introduced at top of chamber, forcing piston down, fluid out), #2 is waiting (filled, ready to discharge just before #1 stops discharging), and #3 is filling (by force of gravity, with power-impelled filling optional). Filling and discharge actuated by electric control box. Chambers are stainless steel. Operating air pressures from 10 to 1000 psi. *Crossley Machine Co., Trenton, N.J.*

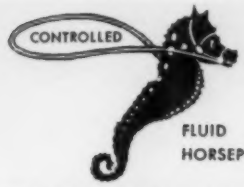
Circle **417** on Time-Saver Card

SWITCH WITH NEON INDICATOR

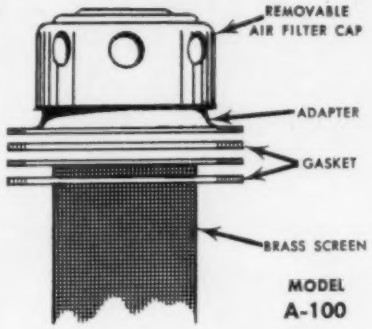
Neon light on side of switch or mounted remotely, indicates whether power is on. Switches are metal enclosed. Neoprene boot protects from dust and splashing liquids. Rubber gaskets on all removable housing parts. Switches have internally tapped ½" conduit fittings, mount right or left. 2-page bulletin covers internal switch, panel light, and actuator types: sealed plunger, sealed adjustable

Continued on next page

Circle **113** on Time-Saver Card



FILLER-BREATHER CAPS



REDUCE YOUR COSTS

1 to 4 — $4.00 10 to 24 — $3.10

5 to 9 — $3.50 25 and up — $2.80

PAUL-MUNROE CO.

6430 EAST GAGE AVE.

BELL GARDENS, CALIFORNIA

the 2569

MURPHY

SEPARATOR

does a smooth job of

SEPARATING and EJECTING

water, oil, scale, and rust from

COMPRESSED AIR LINES

YOU SHOULD HAVE FULL INFORMATION

Write now for FREE Data Sheet No. 2569

JAMCO

JAS. A. MURPHY & CO., INC.

1417 EAST HIGH STREET, HAMILTON, OHIO

Circle **104** on Time-Saver Card

free catalog

47-page catalog illustrating complete line of

ALLEN AIR

AIR CYLINDERS
AIR VALVES & CLAMPS
DIAL FEED TABLES

The cylinder of "distinction" shown above is a Factory Reject. Only straight rods available.

ALLENAIR CORP., 255 East 2nd St., Mineola, N.Y. AH-11

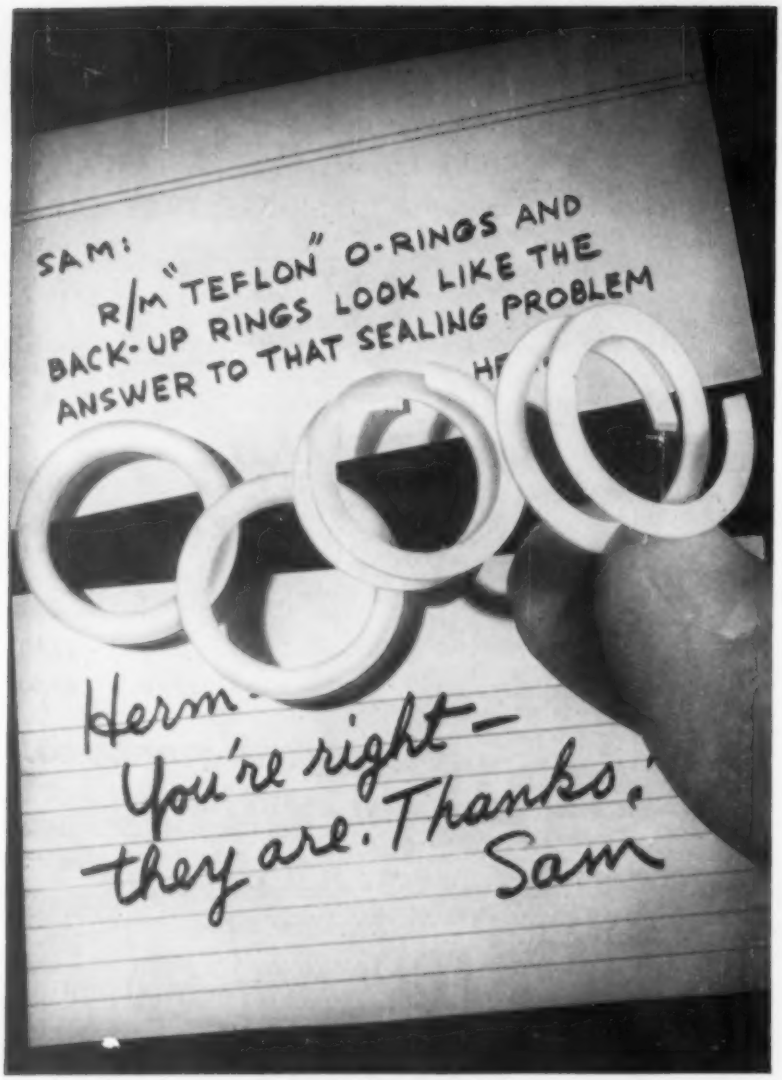
Name _____

Company _____

Address _____

City _____ Zone ____ State _____

Circle **8** on Time-Saver Card



"Teflon"* O-Rings and back-up rings, precision machined by R/M, give you a reliable solution to many difficult sealing problems. Top-quality production techniques provide accurate fit and consistent performance.

In addition, the unique characteristics of "Teflon" make it your best choice for handling many difficult liquids. "Teflon" is not affected by any known industrial acids or caustics. It has no known solvent. It is nonadhesive and noncontaminating. It is unaffected by weather, its water absorption is zero, and it performs efficiently within the temperature range -80° to +500°F.

R/M engineers have amassed a wealth of experience in manufacturing packings and gasket materials to satisfy the most exacting requirements of industry. This experience is at your disposal—call on R/M!

R/M MAKES A COMPLETE LINE OF MECHANICAL PACKINGS—including Vee-Flex,* Vee-Square,* Universal Plastic, and "versi-pak"*; GASKET MATERIALS; and "TEFLON" PRODUCTS. SEE YOUR R/M DISTRIBUTOR.
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R/M PACKINGS
RAYBESTOS-MANHATTAN, INC.
PACKING DIVISION, PASSAIC, N.J.
MECHANICAL PACKINGS AND GASKET MATERIALS

RAYBESTOS-MANHATTAN, INC., Mechanical Packings • Asbestos Textiles • Industrial Rubber • Engineered Plastics Sintered Metal Products • Abrasive and Diamond Wheels • Rubber Covered Equipment • Brake Linings Brake Blocks • Clutch Facings • Industrial Adhesives • Laundry Pads and Covers • Bowling Balls

Circle **119** on *Time-Saver Card*

USEFUL LITERATURE

roller, roller-plunger, sealed adjustable manual, and sealed roller plunger. Data on operating force, release force, pre-travel, moment differential, and over-travel. Dimensions. Illustrations. *Acro Division, Acro Div. Robertshaw Controls Co., Columbus, Ohio.*

Circle **418** on *Time-Saver Card*

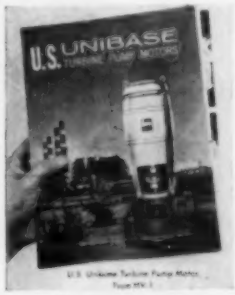
AIR CONTROL VALVES

Bulletin 8100 covers hand operated valves (hydraulic or pneumatic to 250 psi), foot operated (pneumatic to 125 psi, hydraulic to 100 psi), pilot operated (pneumatic to 150 psi). Illustrations, dimensions, specifications. Bulletin 8101 deals with electrically, manually, and pilot-operated valves for air, oil, water, other gases or liquids, and vacuum. Pressures to 125 psi. Temperatures from —40 F to 225 F. Corrosion resistant parts. *Cleveland Pneumatic Industries, Skokie, Ill.*

Circle **419** on *Time-Saver Card*

PUMP-MOTOR

Vertical motor is designed for short-coupled industrial service. Integral construction eliminates spacer base, gives easy access to coupling, provides strength for



bracket rigidity needed for direct coupling. Pump impellers can be adjusted without disassembling shaft. Bulletin F-1975. *U.S. Electrical Motors, Inc., Los Angeles, Calif.*

Circle **420** on *Time-Saver Card*

POROUS METAL FILTER MEDIA

For filtration of liquids or gases under extreme conditions of temperature, highly corrosive atmospheres, high differential pressure, and excessive shock and vibration. Uniform pore structure. End caps

and fittings are fused to the porous metal section. Furnished with a variety of end caps or fittings. Sections up to 36" long, 6" diameter. Specifications, graphs of capacities, drawings, and dimensional data. *Purolator Products, Inc., Rahway, N.J.*

Circle **421** on Time-Saver Card

BACK-UP WASHERS

Washers are leather and synthetic elastomer combination. They support and protect O-rings and other packing shapes. Bulletin includes application suggestions, and data on material performance in synthetic fluids, temperature range, groove design and dimensions. 4 pages. *C. W. Marsh Co., Muskegon, Mich.*

Circle **422** on Time-Saver Card

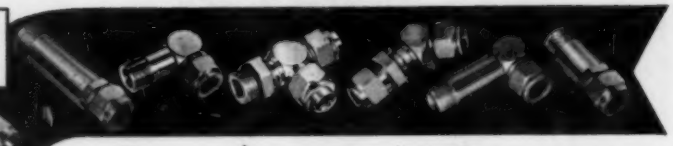
ROLLING DIAPHRAGMS, MANOSTATS

Long stroke, deep convolution, constant area diaphragm, free positioning, with complete relaxation at any point in stroke. Moves axially, rolls off piston sidewall onto cylinder sidewall with smooth and

Continued on next page

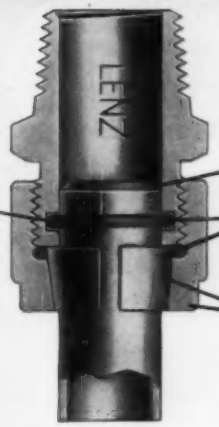
Circle **91** on Time-Saver Card

A FITTING FOR EVERY NEED



Specify LENZ O-RING J.I.C. Approved TUBE FITTINGS

Select From A Complete Line! Tapered or S.A.E. Str. Thread J.I.C. 2 and 3 Pc. 37° Flares Pipe Fittings • Accessories



NO METAL TO METAL SEAL
NO EXACT TUBE LENGTH NECESSARY
THE HIGHER THE PRESSURE THE TIGHTER THE SEAL
NOT NECESSARY TO CUT TUBE SQUARE
SEAL AND GRIP ARE SEPARATE
ABSOLUTELY LEAKPROOF CONNECTIONS
HELD BY FRICTION GRIP OF THESE TWO
EVERY JOINT IS A UNION
A HACKSAW AND FILE . . . ONLY TOOLS NEEDED

Patented • Patents Pending

You can't beat LENZ Tube Fittings for time saving and complete fitting assurance on any air, hydraulic or piping system installation. You get the finest quality from a specialist devoted exclusively to the manufacture of Steel Tube, Hose and Pipe Fittings.

Free Write for our newest complete line catalogs . . . ask to be put on our mailing list.

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Distributors In Principal Cities

THE COMPLETE PACKING UNIT for Hydraulic or Pneumatic rods and cylinders

MON-O-PAK® CARTRIDGE

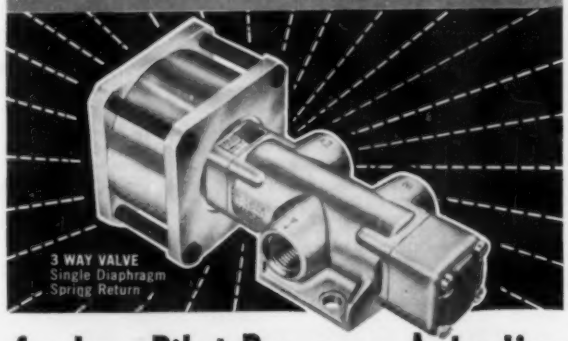
- Easily and quickly installed.
- No adjusting necessary.
- Equipped with Anti-Backlash rings.
- Includes Seal-Guard® rod wiper.
- Low friction coefficient.
- Shock and burst proof.
- Reduces initial machining cost.
- Gives longer service life.
- Cuts machine down-time.
- Easily removed for replacement.

Write for catalog and prices.

HYDRAULIC ACCESSORIES CO.
24301 Hoover Road, Warren Mich.

Circle **80** on Time-Saver Card

VERSA Diaphragm Actuated Valves



for Low Pilot Pressure Actuation

Versa Diaphragm Valves can be actuated by pilot (or signal) pressures as low as 5 PSI on double diaphragm types and as low as 10 PSI on standard spring return models.

Versa Diaphragm Valves are available with side port bodies or for manifold mounting, and in sizes from 1/8" thru 1" NPT in 2-, 3-, 4-, and 5-way types, and for pressures from partial vacuum to 500 PSIG.

All Versa Valves are triple pressure and functionally tested under water for guaranteed leakproofness.

VERSA

VERSA PRODUCTS COMPANY INC.
248-A SCHOLES STREET
BROOKLYN 6, N.Y.

Write Today for your free copy of bulletin 259

Circle **145** on Time-Saver Card

CHOICE OF TWO DESIGNS...

Palmetto PYRAMID® PACKINGS

. . . for effective sealing on Rods and Rams

This *advanced* form of V-type packing is offered in two distinctive designs for broad hydraulic and pneumatic service. Sets of *shallow* Palmetto Pyramid serve where the packing space is limited . . . *deep* Palmetto Pyramid sets are used where space is not a factor. Both designs have strong, heavy walls to resist extrusion — extend packing life.

In addition to Palmetto's unique adaptation of the "V" concept there is more to Palmetto Pyramid Packings than meets the eye. Reinforced styles, for example, are constructed with continuous plies of fabric — endlessly folded — that follow the molded form to withstand stresses exerted from all directions. Quality materials throughout, also not readily discernible, contribute to the performance you seek.

Palmetto's recommendations concerning the use of Pyramid Packings can be made quickly and accurately when the following is supplied:

• Your drawing showing dimensions and tolerances of the stuffing box and rod and of the piston and cylinder • A description of the fluid • Maximum pressure • Minimum and maximum temperature • Speed and direction of motion

SEND FOR LITERATURE—

Let us help you design-in a more effective seal. For complete technical data on Palmetto Pyramid Packings request your complimentary copy of Bulletin PY-959.

NOTE: Another useful packing fact book, just printed, is available to design engineers. Ask for Bulletin GTR-759 covering Palmetto G-T Rings.

GREENE, TWEED & CO.
NORTH WALES, PA.

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USEFUL LITERATURE

continuous frictionless motion. Often performs both bellows and diaphragm functions. Can replace cup packings and O-rings. Linear actuators utilize diaphragm. Diaphragm's self-aligning characteristics enable actuator to withstand severe mechanical abuses without affecting operation. Manostat is a pressure controller utilizing servo system. Pilot nozzle controls main valve action. Ample sized exhaust and supply seats give instantaneous adjustment of control pressure. Pilot pressure bled directly to atmosphere. Low air consumption, since lower regulator pressure is used for pilot energy. Extremely high gain. Brochure BF 301-A. *Bellofram Corp., Burlington, Mass.*

Circle **421** on Time-Saver Card

SEAL FOR PIPE THREAD

Lock nut has tubular portion at its base. Split ring of reinforced polyamide compound is inserted into void between interior of tubular section and fitting groove. Edge is then crimped to retain resilient sealing medium. Can be used with standard SAE straight thread port. Withstands over 10,000 psi. No hydraulic fluid limitations. Report #2. *Imperial Brass Mfg. Co., Chicago, Ill.*

Circle **422** on Time-Saver Card

PACKINGS CATALOG

Chemical selection chart lists over 700 liquids. Each packing style has identifying symbol. Cross-section photos of materials. Packing selection chart relates operating conditions to packing types. Includes section on packing troubles. Form PK-131A, 64 pages. *Johns-Manville,, New York, N.Y.*

Circle **423** on Time-Saver Card

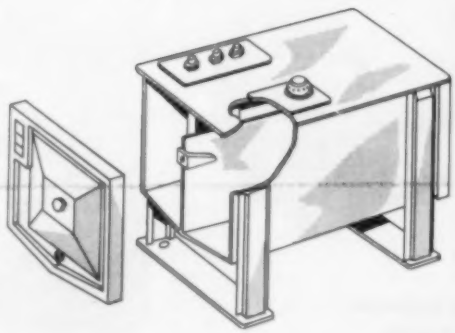
SERVOVALVES

Product Bulletin 104 describes operation and performance characteristics of Moog's new 71 Series industrial servovalves. Includes functional schematic, performance curves, valve specifications. Installation and overall dimensions. *Moog Servocontrols, Inc., East Aurora, N.Y.*

Circle **424** on Time-Saver Card

Continued on page 155

Tomorrow's best engineered hydraulic reservoir . . . TODAY!



HYDRO-CRAFT RESERVOIR

- 100% Cleanability
- Non-Welded Design
- 2 Recessed Sight Gages
- Self Sealing End Covers
- Rugged Construction
- Down Line Access Covers

Distributorships available in a few territories

Conforming to the latest J.I.C. standards these units are equipped with completely removable end covers and baffle, non-welded construction assures against residual weld scale and sand blasting materials, down line access covers permit bench work installation of all down lines. All parts mount interchangeably. Sizes 10-120 gallon in stock.

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POWER UNIT ASSEMBLIES • FIELD INSTALLATIONS • SYSTEMS ENGINEERING

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250 psi AIR
to 2000 psi
HYDRAULIC

ONE Price...

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MODIFIED WITH TAPERED CUSHIONS
FOR LOW PRESSURE HYDRAULIC SERVICE!

FINEST OF THE INTERCHANGEABLES is this improved new dual-purpose C5 SERIES Air Cylinder from Sheffer of Cincinnati, machine tool center of the world. The ultimate in design, construction and performance. Long, low-cost service life. Write NOW, for NEW BULLETIN NO. 459.

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- CARTRIDGE quickly removed without disassembly
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- Meets or exceeds JIC
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AIR VALVES from stock

A complete range of two, three and four-way valves in sizes ¼", ⅜", ½", ¾".

- High quality—Low cost.
- Compact—Light weight.
- Fast delivery from stock.
- Simplified design—Easy maintenance.

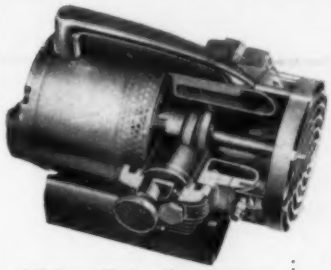
Double solenoid, ball-detented model shown.

AIR VALVES COMPANY
24581 Groesbeck Hwy., Warren, Mich.

Oil-Free COMPRESSED AIR FROM YOUR CHOICE OF 58 MODELS

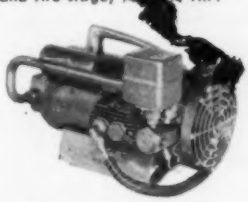
Completely oil-free air—no lubrication ever needed when you choose one of these 58 B&G Oil-less Compressors. Carbon graphite piston rings and skirts need no lubrication—motor bearings are *permanently* lubricated. Numerous other design and construction features assure long life and smooth dependable delivery of cleaner, cooler, drier air.

For portable or built-in applications, these lightweight, compact compressors give maximum air per horsepower.

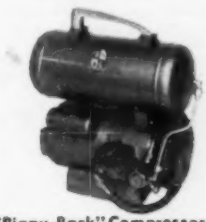


Oil-less Motor Compressor Units—35, 75 and 175 lb., single and two-stage, ½ to ¾ H.P.

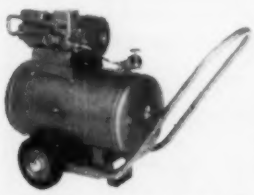
Bare Compressor (less Motor)—35, 75 and 175 lb. pressures, for belt-driven applications.



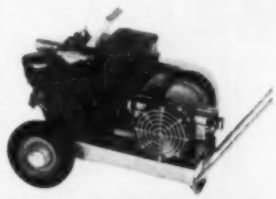
Tankless Motor-Compressor Outfits—for use where existing air tanks or pipe lines provide air storage. 35, 75, 175 lbs., single and two stage. ¼ to ¾ H.P.



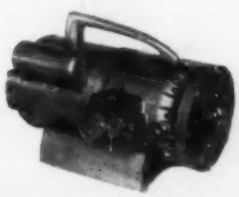
"Piggy-Back" Compressor Tank—Handy 2-gallon tank mounts on any B&G 75 or 175 lb. Motor Compressor or Tankless Outfit.



10-Gallon Air Tank Motor-Compressor Outfits. 35—175 lbs.—mounted on Code or non-Code Tanks. Portable when cart-mounted.



Gasoline Engine-Driven Compressor Outfits—Weighs only 55 lbs., compact, cart-mounted. Delivers air up to 90 psig. continuously.



Vacuum Pumps—will pull up to 28" vacuum—continuously! Oil-less construction means no messy discharge vapors.

30-Gallon Air Tank Motor Compressor Outfits—75 and 175 lb. units. Vertical or horizontal ASME Code tanks tested to 400 lbs. ¼ to 1½ H.P.

Send for Catalog GO-259

Oil-less AIR COMPRESSORS

BELL & GOSSETT COMPANY
Dept. FY-66, Morton Grove, Ill.

Canadian Licensee: S. A. Armstrong, Ltd., 1400 O'Connor Drive, Toronto 16, Ont.

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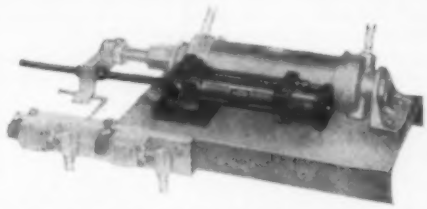
Circle **102** on Time-Saver Card

VERI-TROL HYDRAULIC
CHECKING CYLINDERS



—designed for use with air cylinders to smooth out stroke variations due to compressibility of air under irregular load conditions.

- ACCURATE SPEED CONTROL is dial-set, load-compensated to assure uniform stroke speed even with irregular loads.
- VISIBLE OIL RESERVOIR, easy to refill.
- 2,000 LB. CHECKING CAPACITY on out stroke, free return.
- 2", 4", 6", 9", 12", 15" and 18" checking stroke lengths.
- IDEAL FOR LOW-COST TOOL OR WORK-PIECE FEEDS.

Take the bumps and jumps out of air cylinder operation — install VERI-TROL checking cylinders wherever you want smooth, accurately-controlled stroke speed. Write now for free data bulletin.

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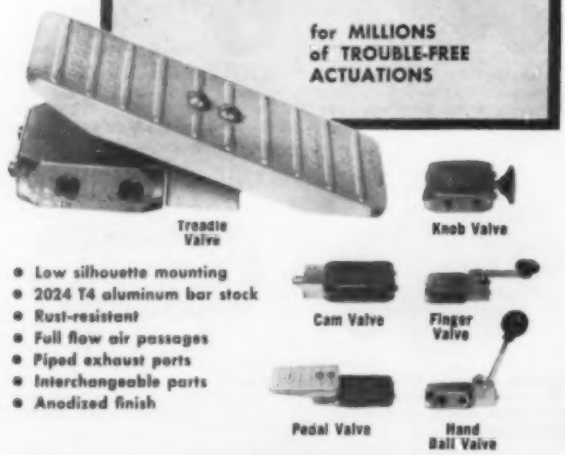
5007 BROOKPARK RD., CLEVELAND 34, OHIO 34

new ROTORAM® VALVES

WITH EXCLUSIVE ROTATING STEM
for MILLIONS of TROUBLE-FREE ACTUATIONS



- Low silhouette mounting
- 2024 T4 aluminum bar stock
- Rust-resistant
- Full flow air passages
- Piped exhaust ports
- Interchangeable parts
- Anodized finish

Rotoram Valves are available in 3 and 4-way models for ⅛", ¼", ⅜" and ½" pipe sizes. Special Block "V" Packing permits free ram movement, insures long valve life. Port entry from either left or right side. Ask your AIR-MITE Distributor, or write for complete details and illustrated catalog.

AIR-MITE DEVICES, INC.
4401 W. Kinzie St., Chicago 24, Ill.

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REPRINTS

The following reprints of special reports which have appeared in APPLIED HYDRAULICS & PNEUMATICS Magazine are available:

TEMPERATURE CONTROL IN HYDRAULIC SYSTEMS . . . By Allan E. Morris

A complete report on latest developments. Sixteen pages of data on heat generation, fluids and packings, heat dissipation, system design, oil coolers, immersion heaters, and automatic temperature control.

COMPONENTS FOR WATER HYDRAULICS . . . By Allan E. Morris

A special 16-page report covering the design, selection and sizing of pumps, valves, accumulators, packings and cylinders. The report covers also additives and air controls.

WHAT YOU CAN GET IN ELECTRO-HYDRAULIC SERVO VALVES . . . By Wayne Kinney and Phillip Weiss

A special report showing a wide variety of electrohydraulic servo valves. Includes an article on how contamination affects servo valve design.

WHAT TO LOOK FOR IN AIR VALVES . . . By Allan E. Morris

This 16-page report contains basic designs of directional control, pressure control and flow control valves. Illustrates many different designs and points to remember in selecting a specific design.

Single copies 50¢; over 50 copies, 35¢ ea.

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USEFUL LITERATURE

MINIATURE TIME DELAY RELAY

Relay is unaffected by voltage variations, is instantaneously recycling. Adjustable from .030 to 120 sec. Available for operation on energizing or de-energizing. Coils in a range of voltages for ac or dc. Hermetically sealed or dust-tight housings provided with octal-plug, solder lug, or AN connector terminals. Bulletin SM-2 gives full specifications, diagrams all details for installation. Unit measures 4⅝" x 1 13/16" x 1½", weighs 15 oz. *AGA Division, Elastic Stop Nut Corp. of America, Elizabeth, N.J.*

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USE A TIME-SAVER CARD FOR MORE INFORMATION ON

- ADVERTISED PRODUCTS
- NEW COMPONENTS
- USEFUL LITERATURE

RUBBER PARTS

Bulletin has list of rubbers most often used, and detailed account of physical properties. General comparison of rubbers includes categories of aging, resilience, tear and abrasion resistance. Discussion of manufacture and quality control. *Garlock Packing Co., Palmyra, N.Y.*

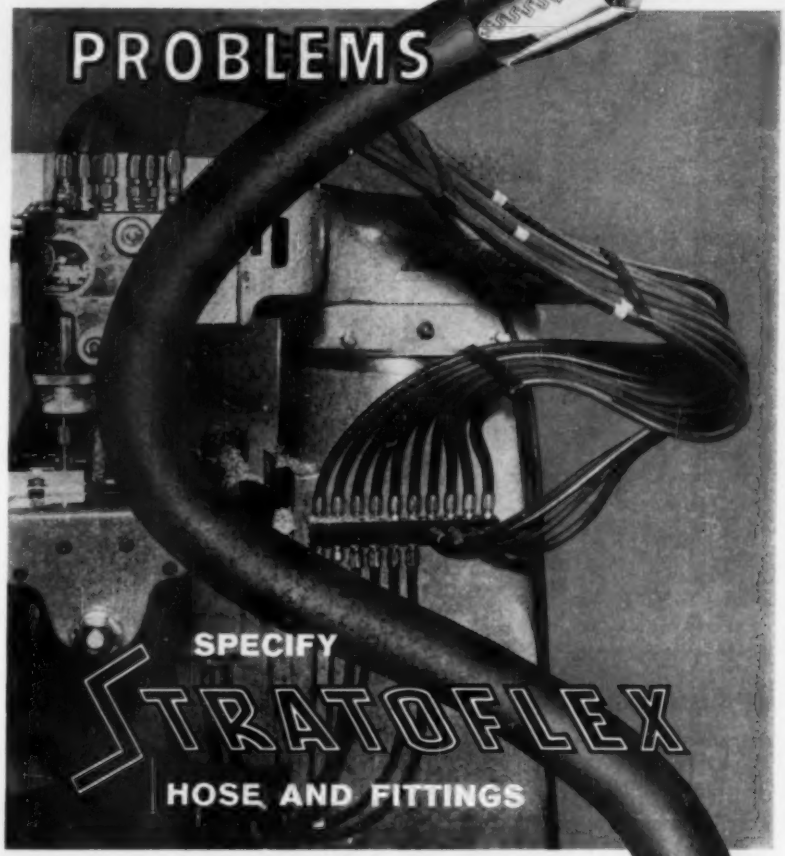
Circle **426** on Time-Saver Card

POWER AND CONTROL FOR LOCKS

Fluid Power News 10, includes descriptions of nine marine lock applications of fluid power. Covers linear and rotary power applications for vertical lift gates, sector gates, miter gates, and tainter valves. Photos, drawings, diagrams. *The Oilgear Co., Milwaukee, Wisc.*

Circle **427** on Time-Saver Card

SOLVE DESIGN and MAINTENANCE PROBLEMS



SPECIFY STRATOFLEX HOSE AND FITTINGS

Stratoflex was specified for the precision hydraulic tracing control kit on this tool room milling machine.

When you design with Stratoflex you get more than the vibration and stress resistance inherent in flexible hose. You get hose fittings designed to meet your specific requirements. And with Stratoflex leak-proof reusable fittings you simplify maintenance by making possible quick, easy replacement or modification. You solve both design and maintenance problems when you specify Stratoflex.

Write for Bulletin S-2 today

SF10-8

STRATOFLEX Inc.

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Branch Plants: Hawthorne, Cal., Fort Wayne, Toronto
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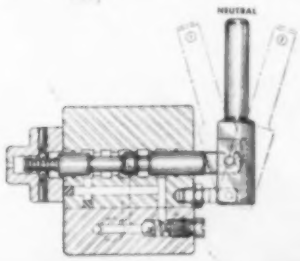
Circle **133** on Time-Saver Card

new 10,000 psi FOUR-WAY VALVES

effortless operation for applications up to 10,000 psi

Have valving problems on hydraulic applications calling for high pressures up to 10,000 psi? This new GREENLEE Four-Way Valve may be your answer. Simple, trouble-free spool-type valve . . . completely balanced to provide effortless operation at any pressure in any position. It operates with the same ease at 10,000 psi as at 0 psi. Panel mounted for universal adaptability. Subplate available. Precision-made, precision-tested. (Max. leakage 4 cu. in. per minute at 10,000 psi.) Write today for illustrated data sheet.



GREENLEE Four-Way Valve is available in two models: No. 1717 (above) with detent-positioned control lever . . . No. 1704 with spring-centered control lever.

THE GREENLEE LINE ALSO INCLUDES A WIDE SELECTION OF HAND AND POWER-OPERATED HYDRAULIC PUMPS

GREENLEE

GREENLEE TOOL CO.

1776 Columbia Ave., Rockford, Illinois

Circle **67** *on Time-Saver Card*

POST SCRIPTS OF INDUSTRY

News about people, manufacturers and sales organizations

Dowd to manage marketing research at Garlock

Dowd

James Dowd, newly appointed manager of marketing research for the Garlock Packing Co., Palmyra, N.Y., will handle domestic and international marketing studies covering the firm's nine major product lines. Dowd, currently chairman of the industrial section of the American Marketing Assn., was formerly assistant manager, market development department, Air Reduction Sales Co., New York.

Weinman Pump observes 40th anniversary

The semi-annual directors meeting of the Weinman Pump and Supply Co., Pittsburgh, Pa., was held on August 14, exactly forty years after Charles E. Chalfant founded the company. Originally a jobber of coal mine pumps, the Weinman firm later distributed pumping machinery, then became a manufacturer and designer of hydraulic and lubricating equipment. Chalfant, the founder, is now president and chairman of the board.

Lutz is Kobe's eastern representative

Lutz

Marshall S. Lutz, now eastern sales representative for Kobe, Inc., Huntington Park, Calif., will headquarter in Detroit, Mich. He will be responsible for eastern sales and service of the Kobe high pressure triplex plunger pumps in the industrial, automotive, and aircraft fields.

Owings joins Briggs R&D staff

Kenneth B. Owings has been appointed project engineer on the research and development staff of the Briggs Filtration Co., where he will be in charge of work on diesel and industrial lubricating oil filtration.

Huston named asst. chief engineer

Frederick P. Huston, recently appointed assistant chief engineer for Tube Reducing Corp., Wallington, N.J., will administer engineering department functions including quality control, product and methods engineering, and metallurgy. He joined the firm in 1953.

Holzbock joins Sanders Associates

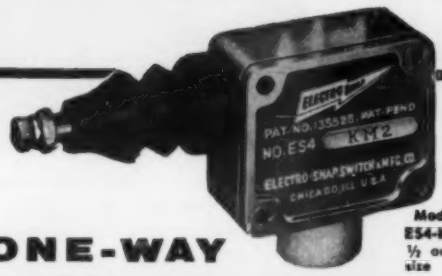
Holzbock

Werner G. Holzbock has been appointed assistant manager of the instrument and control systems laboratory of Sanders Associates, Inc., Nashua, New Hampshire. He was formerly staff engineer with the Celanese Corp., Charlotte, N.C., and chief engineer for GPE Controls, Inc. Holzbock holds patents for electro-hydraulic valve actuators and a boiler supervisory system. He has written two books on measurement and control instrumentation. He will contribute to the development of the Sanders line of electro-hydraulic servo valves.

Volk joins Houghton staff

John J. Volk has joined the Houghton staff of hydraulic engineers, in a sales capacity. He has

Continued on page 158



Model ES4-KM2 ½ actual size

ONE-WAY IMPULSE SWITCH

simplifies sequencing circuits

- ★ Eliminates Interlocking Switches and Complicated Actuating Dogs
- ★ Exclusive one-way actuator sends electrical pulse when depressed, then opens circuit. No pulse on actuator return.
- ★ Gives More Dependable Operation — replaces complicated controls
- ★ Lowers Cost of Control Circuits—fewer switches required
- ★ Faster Automatic Operation — closer sequencing possible

10 amps, 125v AC

Four models available with pulsing strokes from 1/16" to 3/8".

Described in Data Sheet ESF-11

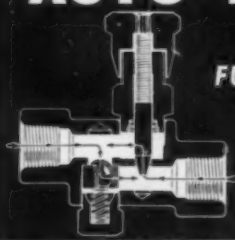
$10.50 plus 25c shipping. Write for Quantity Discounts

ELECTRO SNAP

ELECTROSNAP CORPORATION
Switch Division
4224 W. Lake St., Chicago 24, Ill.

AUTO-PONENT®

HYDRAULIC FULL FLOW VALVES



Flow Control, Needle, Check, for HYDRAULIC Power

Model KF Flow Control Valve with Dial and Knob adjustment for direct reading and duplicating reference. Now available in Aluminum for 3000 psi.

Pat. #2,841,174

A complete line: ⅛", ¼", ⅜", ½", and ¾" female Dryseal Pipe Sizes in all models and types. Equivalent Aeronautical Tube Sizes on special order.

MINIMUM PRESSURE DROP AND POWER LOSS . . . Oversize ports and passages give maximum flow at minimum pressure drop, insure greater accuracy and response in hydraulic or large volume air cylinder control.

EASY FLOW ADJUSTMENTS under full pressure. Seal located at port to eliminate air or dirt traps. Gland structure equally effective on pressure or vacuum.

SENSITIVE, CHATTERLESS BALL CHECK . . . Patented design insures rapid ball movement to open or close at low differentials.

FORGED BODIES permit higher pressures with wide safety margins. Aluminum—3000 psi; Steel and Stainless Steel—5,000 psi. Pressure ratings based on better than 5 to 1 safety factor. All internal parts are Stainless. Write for illustrated catalog.

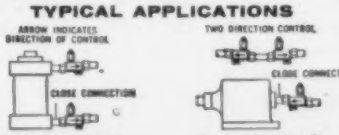
Model F Standard Flow Control Valve or Model N Needle Valve.

Model KF Knob and Dial Flow Control Valve or Model KN Needle Valve.

Model FF Knob and Dial Flow Control Valve or Model FN Needle Valve for panel mounting.

Model C Check Valve for In-Line Mounting.

TYPICAL APPLICATIONS



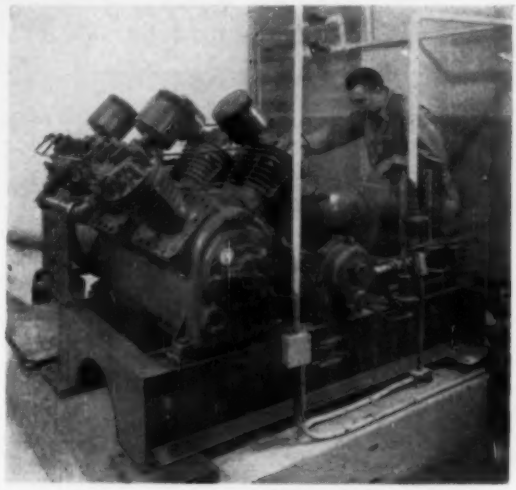
Controlling Double Acting Cylinder

Controlling Single Acting Cylinder

AUTOMATION AUTO-PONENTS INC. COMPONENTS

2919 GRANT STREET
BELLWOOD (Chicago Suburb) ILLINOIS

CONTROL MANUFACTURERS



Typical installation shows Brunner compressors providing a dependable source of compressed air for operating pneumatic control of the large air conditioning system in New York's Socony Mobil Building.

PREFER

BRUNNER SINCE 1906

AIR COMPRESSORS

for 6 good reasons

They'll tell you . . . BRUNNER Air Compressors

- Are outstandingly dependable
- Provide oil and moisture free air
- Offer single or 2 stage equipment in all sizes
- Supply complete air or water cooled aftercooler assemblies with all fittings from one dependable source for all compressor sizes
- Provide "entire system" duplex units that are "operation readied" to connect to piping and wiring facilities
- Air conditioning and heating experience of Dunham-Bush engineers enables them to professionally assist in layout for dependable control systems.

WRITE FOR NEW BRUNNER AIR COMPRESSOR CATALOGS

ALSO WATER COOLED AFTERCOOLERS AND OTHER ACCESSORIES BY heat-x A DUNHAM-BUSH SUBSIDIARY

BRUNNER DIVISION

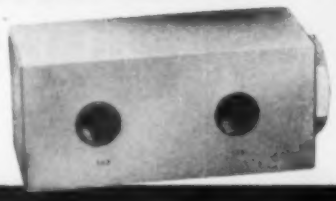
DUNHAM-BUSH

DUNHAM-BUSH, INC.
DEPT. AH, WEST HARTFORD 10, CONN.

Circle **56** on *Time-Saver Card*

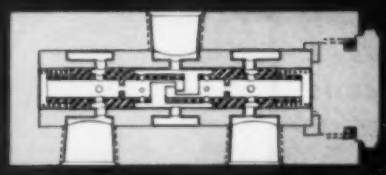
■ **A Practical Way To Equalize Motion Of Two Cylinders . . .**

■ **Accuracy Within 10%, Even With Different Loads**



FLOW DIVIDER

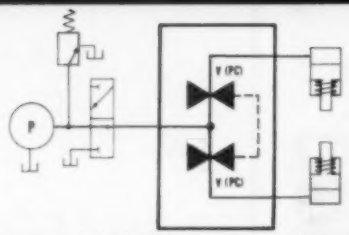
Divides and equalizes flow to cylinders — combines and equalizes return flows.



• For oil up to 2000 psi

INPUT RANGES

1 to 3 gpm
3 to 6 gpm
6 to 10 gpm



Write for detailed literature

Manufacturers of Hydraulic Valves and Devices

Relief Valves • Check Valves • Restrictor Valves
Needle Valves • Pilot Check Valves • Special Valves
Pressure Compensated Flow Regulators

Fluid Controls, inc.

1284 N. CENTER STREET • MENTOR, OHIO

Member of National Fluid Power Association

POST SCRIPTS OF INDUSTRY

had several years of experience in moulded rubber parts since his graduation from Fenn College and his military service.

LeGrand Terry is promoted by Vickers

Terry

LeGrand Terry has been promoted to the position of eastern sales manager, Mobile Hydraulics Division, Vickers, Inc., Division of Sperry Rand Corp. He will supervise mobile sales in twenty-four states from the Midwest to the Eastern Seaboard. Terry joined Vickers in 1951 as an application engineer and, most recently, was district manager of the Mobile Hydraulics Division's Detroit office.

Continued on page 160

STAFFA

HIGH TORQUE VARIABLE SPEED (1-100 r.p.m.) HYDRAULIC MOTOR

Three Models now in production:
Mark III—5 cylinder 3,500 lbs. ft. at 1,500 p.s.i. (Speed 1-100 R.P.M.) **Mark IV**—5 cylinder 4,500 lbs. ft. at 2,000 p.s.i. (Speed 1-100 R.P.M.) **Mark V**—7 cylinder 6,600 lbs. ft. at 2,000 p.s.i. (Speed 1-75 R.P.M.) Overall efficiency 90% to 95%.
Ideal drive for conveyors, rolling mills, cranes, tractors, drills and most mechanical handling applications.

Ask for details of hydraulic cylinders, valves, pumps and motors.

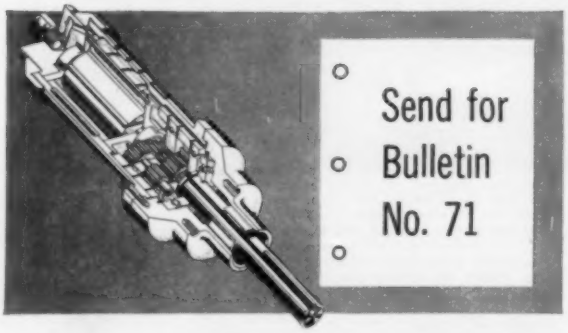
CHAMBERLAIN INDUSTRIES LTD

Staffa Works, Staffa Rd., Leyton, London, E.10, England.
Leytonstone 3678

(Member of the Chamberlain Group of Companies)

Circle **33** on *Time-Saver Card*

Rugged rotary air motors for low hp, heavy-duty service



Compact rotary vane air motors designed by Gardner-Denver for low hp needs requiring heavy-duty service. Develop from ⅛ to 1½ hp. Ideal for jobs requiring quick starts and stops, continuous service or sparkless operation. All moving parts mounted in anti-friction ball or needle bearings. Plus the basic air motor advantages: positive, instantaneous control . . . continuous operation . . . no spark hazard . . . can't burn out. Can be mounted in any position.

EQUIPMENT TODAY FOR THE CHALLENGE OF TOMORROW

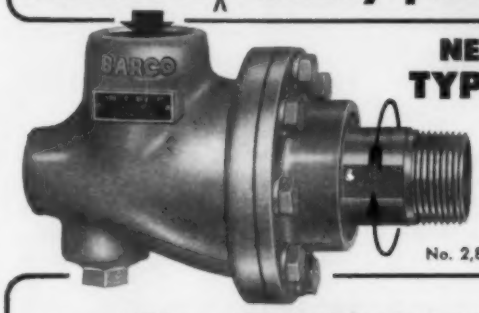
Gardner-Denver Company, Quincy, Illinois
In Canada: Gardner-Denver Company (Canada), Ltd.,
14 Curity Avenue, Toronto 16, Ontario

GARDNER-DENVER

Circle **62** on *Time-Saver Card*

Circle **19** on Time-Saver Card

Better
Need a rotary joint?



NEW TYPE C

Patent No. 2,836,439

-it's BARCO!

For countless applications, Barco's new Type C Rotary Joint will give you the best operating records you've ever had—*and for LESS COST!*

"CRACK-FREE" CHROME PLATED SLEEVE—A standard Barco feature. Minimizes corrosion, friction, wear. Stainless steel spring also standard.

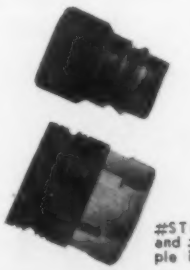
RESISTS SEAL RING BREAKAGE—The spherical seal ring is under compression, not *tension*, loading. Self-adjusting for wear. Seal withstands shock loads and alternating hot and cold service.

WIDE SPACED BEARINGS—Two, instead of one . . . increased bearing area. No lubrication required. Lowest friction.

200 P. S. I. STEAM RATING—Heavy duty service at *no extra cost.* Eight sizes, ½" to 3". *Send for new Catalog 310 today.* **BARCO MANUFACTURING CO.,** 532-M **Hough Street, Barrington, Illinois.**

TRU-FLATE® **SUPER FLOW**

Straight Through Couplers

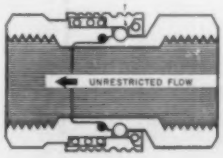


#ST17 coupler and #ST3F nipple illustrated

A complete new series of TRU-FLATE couplers designed to give greater flow with no line pressure drop.

Available in three basic body sizes with mating nipples — female taper pipe threads from ⅛" to 1".

Engineered by "TRU-FLATE", the high quality line of heavy duty "Valve Type" couplers and nipples for air, oil, water, gas, steam, freon, oxygen, etc.



Compare TRU-FLATE with other top quality lines for performance, durability, availability and price.

Write for literature and name of nearest distributor.

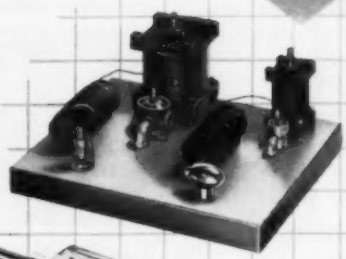
TRU-FLATE® INC.

888-92nd AVENUE • OAKLAND 3, CALIFORNIA

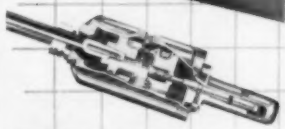
Circle **140** on Time-Saver Card

DESIGN PROBLEMS SOLVED by Humphrey "Quick-Dump" VALVES in these...

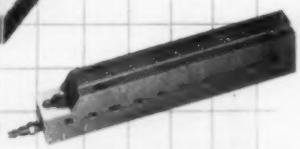
Completely NEW Types of Pneumatic Controls



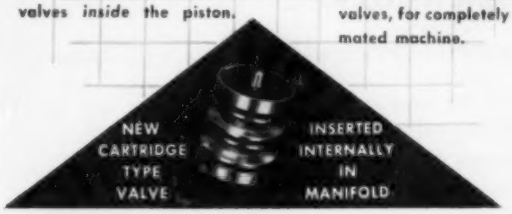
⅛" valves inserted in special hand controls, to valve air signals for instantaneous operation of piloted valves in remote locations.



Double action cylinder with all manually operated valves *inside* the piston.



10-valve manifold using piloted ¼" and ⅛" insert valves, for completely automated machine.



The remarkable versatility of Humphrey "Quick-Dump" valves has pushed back the horizons for design engineers in the pneumatic control field.

You can get "Quick-Dump" valves with round bodies; with square bodies for mounting on manifold; or in new cartridge type for **inserting internally** in manifold. You can have ⅛" Minivalves that deliver 30.45 cfm, ¼" delivering 80.04 cfm, and ⅜" delivering 276 cfm at 100 psi. 2-way, 3-way, 4-way types, operated manually, electrically, or by pilot. All valve air, oil, water, other liquids and gases to 125 psi, as well as vacuum. All have built-in quick exhaust and lightning fast cycling speed.

Consult Humphrey engineers about your requirements in pneumatic controls. They will gladly work with you, or design and produce your special control devices for you.

Humphrey PRODUCTS DIV.

General Gas Light Co. Kalamazoo, Michigan

Complete Line of Standard "Quick-Dumps"

MANUAL ELECTRIC PILOTED

Specialists in Pneumatic Devices

Circle **78** on Time-Saver Card

Unretouched photomicrograph (100 x) shows steel particles which passed through an edge-type strainer with .003 in. spacing. The particles were extracted by a Frantz FERROFILTER.

Remove such ferrous particles from your Hydraulic System with

FERROFILTER®

HIGH PRESSURE Magnetic Separators

Get rid of the ferrous grit which can cause sticking valves as well as abrasive damage to finely fitted components.

Series PH High Pressure FERROFILTER

Working pressures from 2000 to 3000 psi; stock sizes—12 to 40 gpm (hydraulic fluid Mil O-5606)

•

Low pressure models for 100 psi also available.

Send for BULLETIN HP-65

S.G. FRANTZ CO., Inc.

Brunswick Pike & Kline Ave.
P. O. Box 1138 Trenton 6, N. J.

Circle **58** on Time-Saver Card

POST SCRIPTS OF INDUSTRY

Hunt Valve appoints Spuhler

Peter A. Spuhler has been appointed sales engineer for Hunt Valve Co., Salem, Ohio. Before joining Hunt, Spuhler was a sales engineer for northeastern Ohio distributors of fluid power products. He will work in the Salem-Warren-Youngstown area.

Selinger heads product development

Selinger

Paul J. Selinger is now manager of product development for the Standard Tube Co. He will retain his duties of the last six years as manager of stainless sales, and will be in charge of expansion of new application areas for welded carbon and low alloy steel tubing, welded stainless steel pipes and tubing, and rigidized steel tubing.

Roper to represent Sherwood pumps

Roper Hydraulics, Inc., Rockford, Ill., has been appointed by Sherwood Brass Works, Detroit, Mich., as sales representative for the Sherwood line of pumping equipment.

Foglesong and Zar advance at Babcock and Wilcox

F. H. Foglesong was recently assigned to the newly created post of manager of alloy sales for Babcock & Wilcox's Tubular Products

Foglesong

Zar

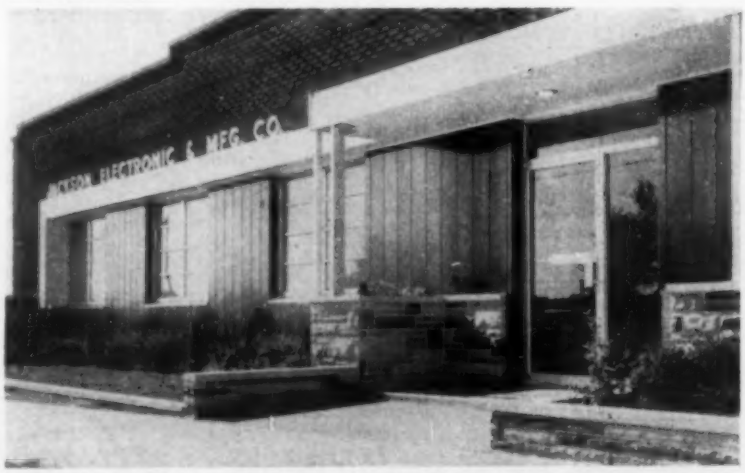
division, Beaver Falls, Pa. Foglesong joined B&W in 1947 as a Detroit district salesman, and became district manager in 1949. A. D. Zar, since 1956 sales representative in Milwaukee, Wisc., was named to succeed Foglesong.

Jacobson moves to Dalmo Victor

Irwin Jacobson has joined Dalmo Victor Company's Hydraulics Division as a senior engineer. Jacobson comes to the Belmont, Calif. company from General Time Corp., Chicago, Ill., where he was a project engineer.

Continued on page 162

Bellows acquires electronics firm



The Bellows Company's recent purchase of the Jackson Electronic & Mfg. Co., Akron, Ohio, will broaden the company's activities in the automation field. The Jackson company does research, development, and production work in the industrial electronic controls field, and produces aircraft and missile electronic test equipment. Key administrative and engineering personnel will remain with Jackson.

Circle **76** on Time-Saver Card

Helicoid Gages give
Sustained Accuracy,
even on the
toughest
jobs

★ Exclusive Helicoid movement has no gears, no teeth. Shock-proof construction protects accuracy through millions of cycles.

★ Bourdon tubes available in four materials—bronze, steel, stainless steel, and K Monel—won't stretch, crack, or leak.

★ Six cases, including new solid-front safety case.

★ External pointer adjustment can't be jarred out of position.

★ A complete selection of gages and accessories.

Write for Catalog G-52.

HELICOID GAGES

Helicoid Gage Division
American Chain & Cable Company, Inc.
929-H Connecticut Avenue • Bridgeport 2, Conn.

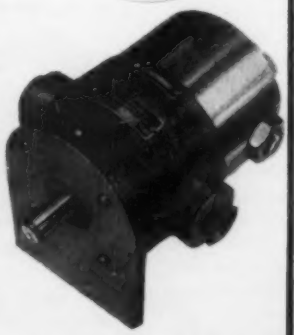
Distributed in Canada by Upton, Bradeen & James, Ltd.
Quebec, Montreal, Ottawa, Toronto, Hamilton, Windsor, Winnipeg, Edmonton, Vancouver

Kingsbury Slipper Type

HYDRAULIC PUMP

For Pressures to 2000 psi

- Clearance at "A" eliminates trapping.
- Slippers seal at "B" and "C" giving wear compensation.
- Slipper pumping at "D" rides on hydrodynamic oil film for minimum friction similar to Kingsbury thrust bearing.
- Springs are not required.



The Kingsbury Slipper Pump is the latest addition to our line of hydraulic equipment for Materials Handling and allied applications which already include:

Tog-Oil® double acting, variable leverage hand pumps for pressures to 10,000 psi.

Hydro-Wheel® for self-propelled lifters. Gives 360° steering and reverse operation.

Write Dept. AP-11 **MECHANISMS CO.**
118 East Second Street, Uhrichsville, Ohio

Circle **99** on Time-Saver Card

NEW!

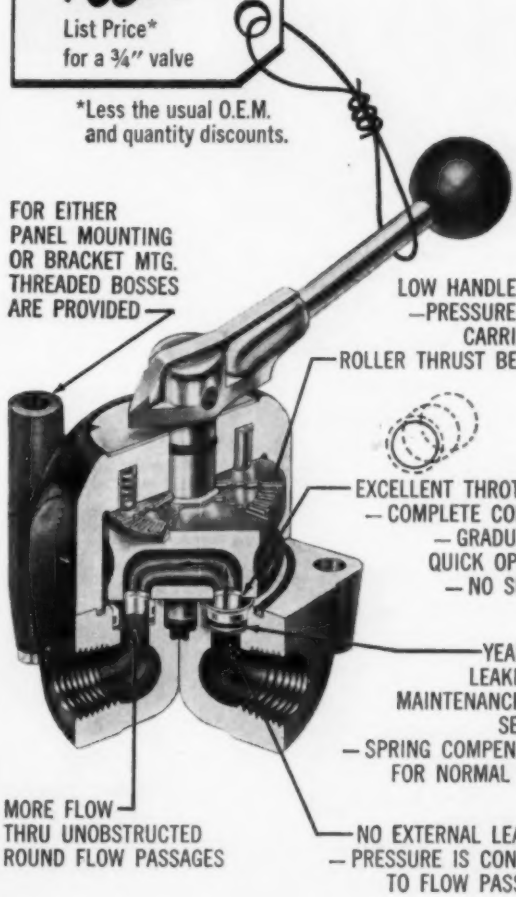
A "SHEAR-SEAL" VALVE

for LESS than a spool valve

RATED FOR 3000 P.S.I. OIL SYSTEMS

$65.00
List Price*
for a ¾" valve

*Less the usual O.E.M. and quantity discounts.


FOR EITHER PANEL MOUNTING OR BRACKET MTG. THREADED BOSSES ARE PROVIDED
LOW HANDLE LOAD —PRESSURE LOAD CARRIED BY ROLLER THRUST BEARING
EXCELLENT THROTTLING — COMPLETE CONTROL — GRADUAL OR QUICK OPENING — NO SURGES
YEARS OF LEAKPROOF MAINTENANCE-FREE SERVICE — SPRING COMPENSATES FOR NORMAL WEAR
NO EXTERNAL LEAKAGE — PRESSURE IS CONFINED TO FLOW PASSAGES
MORE FLOW THRU UNOBSTRUCTED ROUND FLOW PASSAGES

For complete data on this new valve and for information on all your valve requirements write for Catalog V-59-60

CONTROL VALVE DIVISION

barksdale valves

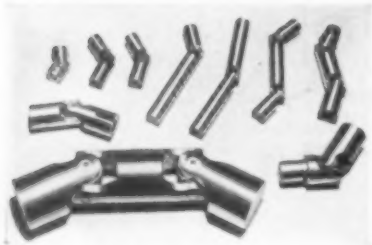
5125 ALCOA AVENUE • LOS ANGELES 58 • CALIFORNIA

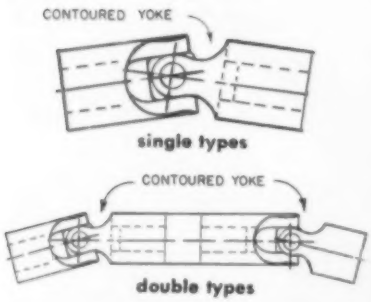
Circle **21** on Time-Saver Card

Lovejoy

UNIVERSAL JOINTS

INDUSTRY'S MOST COMPLETE LINE FOR EVERY SLOW SPEED APPLICATION





Check these features against your requirements:

Special Contoured Yoke—capable of operating at a maximum angular misalignment of 45° on hand-operated applications.

Static Torque—from 306 to 129,693 in.-lbs. at 12°, depending on size of joint.

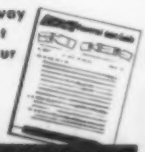
Horsepower Ratings—.54 to 207 at 100 rpm.

Tolerances—pins ground to .0005" ... forks concentric to within .001" ... precision accurate center blocks.

Standard Specifications—hub diameters ½ to 4" ... bores ¼ to 2" ... lengths (single) 2 to 10⅝"; (double) 4 to 21¼". All specifications can be altered or special joints designed to individual requirements.

Get this handy guide

It's the quick and easy way to get the Universal Joint that is just right for your application. Request Bulletin 820.



LOVEJOY FLEXIBLE COUPLING CO.

4839 W. Lake St. Chicago 44, Ill.

Circle **94** on Time-Saver Card

POST SCRIPTS OF INDUSTRY

Fromson establishes New York law offices

Fromson

David Fromson, a director of the National Fluid Power Association, has established law offices in the Franklin National Bank Building, Garden City, New York. Fromson is counsel for NFPA and a member of the Procurement Advisory Committee of National Security Industrial Association.

Chorkey named MAC sales engineer

William J. Chorkey has been appointed sales engineer in the home office of Mechanical Air Controls, Inc., Detroit, Mich. He has been in MAC's engineering department for four years.

Chorkey

Mease

Mease named by Hydreco

Richard R. Mease has been named service manager for Hydreco Division, The New York Air Brake Co., Kalamazoo, Mich. Mease was formerly sales engineer in the mobile sales section.

Sheffer appoints distributors

Four new fluid power application firms will distribute for The Sheffer Corp., Cincinnati, Ohio.

Ralph W. Earl Co., Inc., Syracuse, N.Y., will serve eastern New York State, western Vermont, and northeastern Pennsylvania.

Engineering Equipment Sales Co., Memphis, Tenn., will cover Tennessee.

Goll-Hanford, Inc., Buffalo and Rochester, N.Y., will take the western New York State and northwestern Pennsylvania area.

Price Engineering Co., Inc., Milwaukee, Wisc., will work in Wisconsin and Upper Michigan.

Tube Reducing opens office

Tube Reducing Corporation's new direct factory sales office in Chicago, Ill. will improve Midwestern service to customers of "Rockrite" compression-formed tubing. R. O. Barry will manage.

Flexonics promotes Ford

Ford

Robert F. Ford has been promoted to the position of district sales manager of the Boston district for Flexonics Corp. Ford, who joined the company in 1955 as a senior sales engineer, will be responsible for the sale and distribution of all Flexonics products in the district.

Rucker expands in Portland

The Rucker Co., Oakland, Calif., has moved its Portland, Oregon facilities to larger quarters. Warehouse space has been doubled, and the service and repair departments have been expanded. Laurel E. Cooley, tranferred from Oakland, will head inside sales under branch manager Norman B. Dorries.

Bendix Filter names McFadden sales engineer

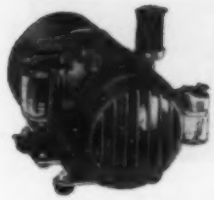
McFadden

Edward C. McFadden is now sales engineer for the Van Nuys, Calif. west coast branch office of Bendix Filter Division, Bendix Aviation Corp, Madison Heights, Mich. During the past six years, McFadden worked with aircraft and missile industries, assisting in all types of fluid filtration problems, including those of cryogenics and exotic fuels.

Continued on page 164

Circle **64** on Time-Saver Card

Model 0321



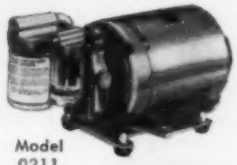
Model 0521

GAST rotary vane AIR PUMPS

— Vacuum or Pressure —

- **Four sizes—Built-in motors**
- **Compact, portable, reliable**
- **For O.E.M., plant or lab use**

To reduce weight, save space and cut costs—use Gast Integral-Motor-Pump Models! Fitted for vacuum—or as air compressors. For oil-free air, some offered with oil-less construction. Very compact and dependable. Positive displacement.
Used as original equipment on instruments, test units, etc. Capacity from ½ to 3.8 cfm; to 28" vacuum or to 25 psi.



Model 0211

Model 0406

Write today for Bulletins V-P-356!

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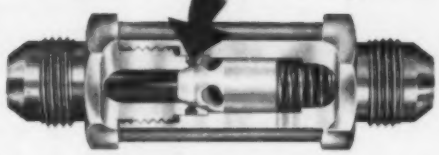
Circle **95** on Time-Saver Card

Kep-O-seal®

RUGGED! DEPENDABLE! CHECK VALVES with the

*Flexible Seal Seat**



- LEAK TIGHT! BUBBLE TIGHT!
- SURGE PROTECTED!
- FLOW—STRAIGHT THROUGH!
- LONG LIFE! EASY CLEANING!
- SIMPLE AND TROUBLE FREE!

The sturdy Kep-O-seal check valve can really take hard service. Conservatively rated, it absorbs severe shock from either direction and always holds its seal. *REMAINS LEAK TIGHT!* Has been proved outstanding in everything from machine tools to missiles! Investigate and see for yourself! Write for full details.

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KEPNER

KEPNER PRODUCTS COMPANY
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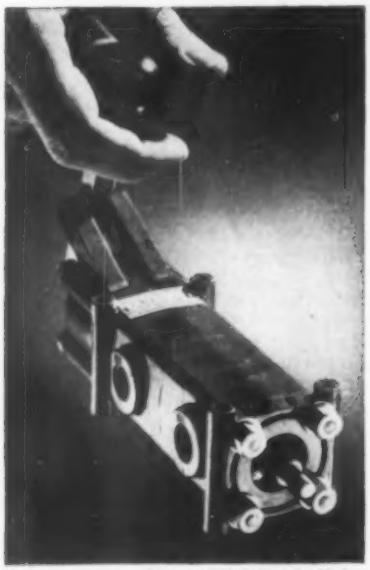
Typical Control Functions solved by **AIR CIRCUITRY**



Westinghouse Type "D" Pilotair Valve

Another of Westinghouse Air Brake's many AIR CIRCUITRY components, the "D" PILOTAIR® Valve is a spool-type directional valve that can be operated by a lever, button, cam, solenoid, air pilot, pedal or treadle. Valves available in two, three, and four-way operation, two and three position, open neutral, lap neutral and vented neutral. Port sizes are ¼" and ½" ips. Operators may be on either or both ends. Max. operating pressure: 250 psi.

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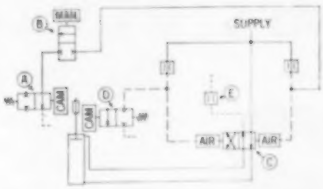
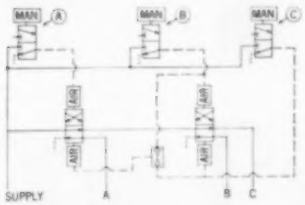
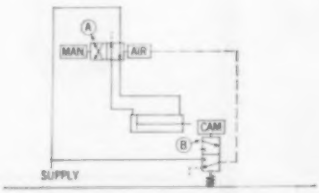
This is the Westinghouse term for application of pneumatic control systems to industrial production operations. Safe, economical, precise Air Circuitry is now being used to solve the most rigorous and complex control problems in industry. Westinghouse Air Brake has pioneered the application and development of air control for more than 80 years. Today our engineers can design an air circuit which will boost production and cut costs.



1. AUTOMATIC CYCLING—Supply air flows to the cylinder to extend the cylinder rod and actuate cam operated valve "A." By operating valve "B" air is bled from the right-hand air pilot of valve "C" to operate this device and retract the cylinder rod. This actuates valve "D" and reverses the process. Cycling time may be changed by regulating the FLOREG® valve "E." The stroke is set by moving the cams on the cylinder rod.



2. STATION TRANSFER—Any of the three stations may capture supply air for the station by operating its respective valve. This may be expanded to any number of stations.



3. AUTOMATIC RESET—To reset the operating valve "A" after completion of an operation. Moving the manual operator admits supply air to the cylinder to extend its rod. At the end of the cylinder rod stroke cam operator valve "B" is actuated to connect supply air to the air pilot operator of valve "A." This returns this valve to its original position. Supply air is then connected to the cylinder to retract the cylinder rod. The circuit is now ready for recycling.

See the Yellow Pages under Cylinders for the Name of Your Local Distributor

WESTINGHOUSE AIR BRAKE COMPANY

INDUSTRIAL PRODUCTS DIVISION, WILMERDING, PENNSYLVANIA

Circle **155** *on Time-Saver Card*

POST SCRIPTS OF INDUSTRY

Titeflex names Ruple v. pres.-gen. mgr.

Ruple

Daniel W. Ruple has been named to the position of vice president and general manager of the Pacific Division, Titeflex, Inc. Ruple, formerly assistant to the president of Titeflex, will head sales, manufacturing, finance, and engineering, from his office in Santa Monica, Calif.

New Distributors

Arrow Valve Corp., Phoenix, Arizona, will stock and distribute Parker synthetic O-rings as a representative of Parker Seal Co., a division of Parker-Hannifin Corp., Cleveland, Ohio and Culver City, Calif.

Ridge Instrument Co., Oak Ridge, Tenn., will stock and distribute industrial tube fittings and tube-working tools made by Parker-Hannifin's Parker Fittings and Hose Division, Cleveland, Ohio.

T. L. Osberger Co., Royal Oak Mich., is now exclusive sales representative in Michigan and northwestern Ohio for the Smoothweld product line of The Standard Tube Co., Detroit, Mich.

The J. A. Moody Co., Wayne, Pa., will handle the line of air valves produced by Mechanical Air Controls, Inc., of Detroit, Mich. Four sales engineers will cover eastern Pennsylvania, southern New Jersey, and Delaware for the Moody firm.

Kerns-Morrell Co., Detroit, Mich., will distribute valves, cylinders, and power units for Rivett, Inc., Boston, Mass. Don Morrell, vice president and general manager of the firm, was formerly in charge of the fluids and electrical section of Ford Motor Co. He assisted in the development of the JIC standards on hydraulics and pneumatics.

DESIGNERS

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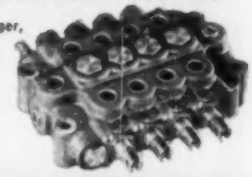

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- For up to FOUR Control Positions
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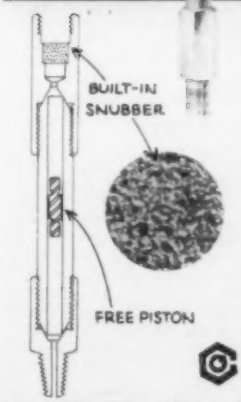

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Operates up to 3000 PSI. Has a built-in return flow check valve. Inlet port ½" AN, outlet 1/4" AN. No. HP-3U

Only 22.50

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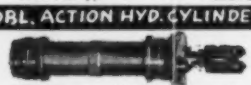

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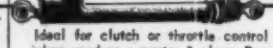

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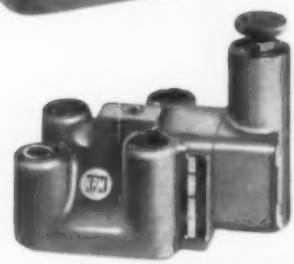

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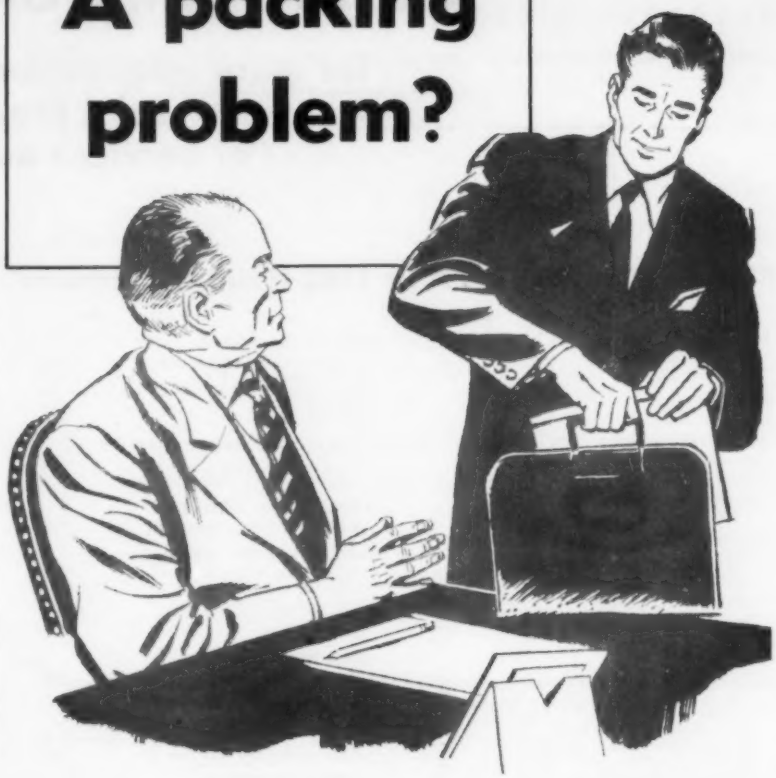

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